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Determination of the U.S. Army Reserve (USAR) Man-Hour Cost of Recruiting and Optimal Reserve Recruiting Model

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Because of the poor correlation with recruiting performance of traditional population measures, a new recruiting propensity measure called *member-adjusted vacancies* was developed. It combined propensity information from the number of TPU members in a ZIP code with potential production information from available vacancies. Member-adjusted vacancies correlate at the 0.91 level with USAR recruit production while none of the traditional measures did better than .21.

An Optimal Reserve Recruiting Model (ORRM) was formulated that (1) maximizes recruit production subject to recruiter limits or (2) minimized the number of recruiters subject to production requirements. The ORRM solves for non-prior service and prior service production separately, providing a long-need element of control for recruiting managers. Because we exploited the special structure of the ORRM, optimal solutions can be quickly arrayed on a spreadsheet and viewed instantly.

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Executive Summary

In 1994 the U.S. Army Recruiting Command (USAREC) recruited or transferred about 40,000 individuals to join USAR Training Program Units (TPU). About 18,000 of these were nonprior service (NPS) enlistments while 21,700 were prior service (PS).

The environment recruiters face at different recruiting battalions varies along many dimensions. Among those of interest are the mix of NPS and PS enlistments, population density, number of U.S. Army Reserve (USAR) recruiters, number and type of TPU vacancies, propensity to join the USAR and the driving distance to the TPU. USAREC commissioned this study to increase their understanding the USAR recruiting market and provide direction for optimizing USAR recruiting costs.

Study Objectives:

Recruiting costs, in terms of USAR recruiters' time were to be determined for each stage in the recruiting process. This process starts with developing a lead to finally placing a soldier in a TPU. The costs were to consider factors such as the mix of enlistments (NPS and PS), the recruiting environment (population density and propensity) and the number and types of TPU vacancies available. The ORRM was to use the above-developed recruiting costs and establish a method for optimizing recruiting efficiency. The ORRM should calculate a standardized cost of recruiting for each type of enlistment mission box in terms of recruiter man-hours.

Study Performance

This study met or exceeded its tasking. We showed the poor correlation with recruiting performance of traditional population measures such as military available (MA) and high school seniors (HSS) as well as related density measures. This resulting in developing a new recruiting propensity measure called *member-adjusted vacancies*. It combines propensity information from the number of TPU members in a ZIP code with potential production information from available vacancies. Member-adjusted vacancies correlate at the .91 level with recruit production while none of the traditional measures did better than .21.

We developed an ORRM formulation that (1) maximizes recruit production subject to recruiter limits or (2) minimizes the number of recruiters subject to production requirements. The ORRM solves for NPS and PS production separately, providing a long-need element of control for recruiting managers. Because we exploited the special structure of the ORRM, optimal solutions can be quickly arrayed on a spreadsheet and viewed instantly.

Background Considerations for USAR Recruiting

Reserve Strength Management

Strategic plans and policies relating to the Army Reserve Component composition, utilization, supportability and resources are integrated into overall defense strategic plans and policies. There is a special need for guidance on the factors that should be considered when deciding Active Army (AA) and Reserve component personnel strengths, force mix, stationing and mission responsibilities. This guidance is important as defense managers consider increasing the Reserve Force strength as one alternative to arms reduction and the additional advantage of reducing defense expenditures.

The size and the mission of the Reserve Forces is growing. This realization, and recent developments concerning the growth and force structure of the U.S. Army Reserve (USAR) and Army Reserve National Guard (ARNG), could well require new policy and procedures for total supportable strength, mission requirement (type unit mix) and selection of unit locations.

The population base from which to recruit reservists is declining and shifting. From 1980 through the year 2000, the national military manpower pool (males age 17 to 29) will decline nearly 13 percent but, the Southern and Western United States will experience overall increases of that population segment. The current Reserve unit locations, with heavy emphasis on units in the Northeast, could easily lead to predictions of strength maintenance problems through the year 2000. What must be resolved is the nature and relationship of successful Reserve recruiting and the placement of Reserve units.

In each instance, the key to successful strength maintenance of Reserve Forces is in the ability and willingness of the local population to support the authorization requirements of local units. This sounds easy enough - put the units where the right people are and watch them fill up. Problems are: leasing is fragmented and often inadequate; construction is on a five- to seven-year plan; force structure planning is on a seven-to ten-year plan; and facilities are expected to last from twenty to thirty years. At the same time, existing force location methodology evaluates historic activity and current demographics but has little information concerning future potential.

In addition to the demand made by Reserve Forces (in terms of authorizations and types of units), there are five other areas which must be considered when making decisions on force location and future strength maintenance: The individual, family, community, business and data validity.

The Individual

The current strength maintenance philosophy assumes that our Reserve units represent a cross-section of society - a type of mini-community. This results in a stationing methodology which measures only the total male population of military available citizens (between the ages of 17 and 29). In reality, many Reserve units appear to be a sub-section of society; a group of individuals with similar interests, values and lifestyles. Certain types of units attract (and retain) predominately certain types of individuals.

Additionally, current Reserve recruiting goals tacitly assume that high-quality, educated young people (recruiting stress is on NPS HS diploma graduates (HSDG)) will remain at the location, or at least in the occupational specialty (MOS) for which they enlist, long enough to be a mobilization asset. In reality, high quality may be good for enlistment statistics and short-term attrition but, as the latest Census Bureau reports indicate, this most highly mobile segment of our society may be detrimental to the long-range readiness of the Reserves. Such a philosophy could be a major contributor to current strength maintenance (completion of initial obligation and reenlistment) and unit readiness problems.

The philosophy assumes that most young people will accept almost any military occupation specialty (MOS) to qualify for the benefits of Reserve membership. However, unlike the AA, the Reserves can only recruit for those unit vacancies which exist in the immediate area (usually defined as within 50 miles). The lack of training opportunities (MOS mix) often places the applicant and recruiter in a "take it or leave it" situation. The motivation to enlist may be a response to incentives rather than dedication. When the incentive is exhausted, the member attrits.

Hispanics represent the fastest growing segment within the high growth sections of the country, Florida, Texas and California. It is important that we understand their culture and occupational needs, which will be reflected in the types of units/occupation specialties they will support. Racial and ethnic values cannot be ignored in force location decisions. One need only to look at the continued Japanese support of the 442nd Infantry in Hawaii to respect this.

Similar to society in general, we know very little about Reservists themselves. Other than data collected during enlistment, there has not been any substantive research to identify the social characteristics of members and correlate this to participation rates. Research begs the questions: Who are they? What kinds of interests and lifestyles do they share? Where are they located?

Data gathering and analysis concerning values and lifestyles is necessary. Through proper market segmentation, we can better address the issues of incentives, motivation, force location and future strength supportability of the Reserves.

Family

The family structure must be evaluated in general economic terms and its effect on unit readiness. Declining unemployment rates, a shrinking manpower pool, and a larger civilian workforce adds competition to the "part-time" employment aspects of Reserve duty.

For example, a recent Census Bureau report reveals that the greatest growth over the past decade has been in DEWKS (pronounced dukes) - dual employed, with kids - families. Together with DENKS (dual employed, no kids) and DINKS (double income, no kids), they now represent the largest element of family market segments. We know very little about the affect of family employment and income status relative to the time requirements and economic incentives of the Reserves. What is necessary for these households to seek a third income - to become DEDI (dual employed and double income)?

Additionally, the increased number of single parents must also be considered - not only in terms of current unit readiness and ineligibility for enlistment but as a social factor. As a simple illustration, since the end of the Vietnam Era (1973), the number of single parent (primarily female-headed) families has more than doubled. A USAREC-sponsored survey of young people (ACOMS) indicated that nearly 40% of the young men surveyed, who had discussed Army service with their parent(s), felt their mother disapproved. How will this, and the Vietnam experience of the parents, affect the propensity of young people coming of age for military enlistment - particularly in the Guard and Reserve?

Studies by Professor Moskos at Northwestern University document the impact of Reserve unit participation. The cost in terms of family, employment, career opportunities and even health cannot be ignored.

Community

Many local communities, assisted by the U.S. Census Bureau's description of Census Tracts as "homogeneous neighborhoods", are redefining the concepts of population growth. Real estate investors, banks and school districts recognize the concept of neighborhood cycles and the impact on facility requirements. Neighborhood cycles is a theory that the age groups and economic structures of local neighborhoods run in clustered cycles. Young families mature and finally become retirees who give way to young families again. Elementary schools give way to high schools which are transformed into community centers (or constructed as expendable or transportable). In the thirty or forty years of a neighborhood cycle, the need for an elementary school could well return. The current revitalization of many downtown areas, stagnation of near suburbs and explosive growth of far suburbs illustrate this.

Long term force location proposals cannot ignore the development of exurbs (business/neighborhood communities beyond the suburb), particularly with recent decisions in Southern California. The impact of these experiments to minimize transportation requirements (and improve air quality) may have serious ramifications on the way the Reserves do business in the future.

Given that Reserve center (RC) facility acquisition and construction could easily take five years, and the unit strength should be maintained for twenty additional years, where is the primary market location? (In anticipation of a discussion on population density, We assume that the lower birth rate of individual families is compensated for by the higher density of apartment/condominium dwellers.) For growth planning purposes, the location of future units might well be in those neighborhoods currently populated by young families and a minimum number of current military-aged individuals.

For purposes of future market supportability, elementary school population could be a primary consideration. If the population is not transient, (that is, mature families with teenagers migrate to other locales and are replaced by other young families), then the youth population will be of enlistment age by the time Reserve unit construction and placement is complete. Likewise, USAR centers located where high schools are closing should be downsized (but not necessarily closed) to wait for the cycle to return.

Highway construction plans could provide a good indicator of future geographical growth patterns. As these roadways isolate some communities and open up other areas to development, planners must be ready to adjust Reserve Center locations. Modular facilities, providing lower construction costs and flexibility, might be considered.

Business

As realized in the Employer Support for the Guard and Reserve Program, the business community must be the Reserve's ally. While some types of units, such as administrative or finance, require general skills which are universal in communities (typist, data processing, bookkeeper), many others need special support.

Units such as fire fighters, aviation, railroad and linguist, require support from the local businesses, not only for training time, but to actually maintain skills and even provide training facilities. The ability and willingness of local employers to become involved and provide this support must be a consideration in the unit stationing decision. This support can be received only if there is a careful consideration for the balance between community needs and military demands. Oversaturation of a unit requirement, such as military police or medical, can lead to friction and training degradation when too many employees seek identical alternative work schedules (both weekends and annual training/vacations) to fulfil both responsibilities. It is possible that mobilization could deprive a community of adequate public safety or health care.

Careful planning with community and business leaders should be a requirement, not just in the sense of economic benefit to the community but in social costs as well.

Future Strength of Reserve Components

Arms negotiations and budget constraints place an ever increasing reliance on the Reserve Forces. As plans are developed for the year 2000 and beyond, we must have a greater awareness of, and be responsive to, the society of which the Reserves are a part. Declining birthrates, increasing median age, realignment of previous marginal markets (females, blacks and hispanics), and geographic shifting of population centers must be viewed, not as problems, but as valid market conditions to be addressed.

If one were to ask today - "What is the total force structure the USAR and Army National Guard (ARNG) could support and sustain ten years from now?" - no one could provide an answer. Necessarily, there would be qualifications: What kind of unit types? Located in which cities? Given what span of command and control? Even if these concerns were addressed, there is no methodology available which can accurately predict future supportable strength levels of the Reserve Forces.

It is necessary to program a proactive research agenda to collect the information, develop the data and design the tools which will provide valid information to the decision maker. The Reserves are unique in their relation to the community and society.

The hypothesis, models and data developed over the years for the AA are not adequate to address the issues of the Reserves. Consequently, the existing data and methodologies fail to predict future Reserve strength growth potential nor address the issue of readiness (MOS qualification rates and mobilization assets). Analysis to evaluate strength supportability must be developed and validated.

For example, parts of California and Texas have similar interest levels for military service but Texas has fewer losses from existing units and California has a higher in-migration rate. The result is similar assigned (percent fill) rates, and recruiting requirements, but radically different readiness levels. On the other hand, Arizona has a lack of authorizations and a consequent overfill of existing units. This has resulted in excessive attrition and poor readiness, due in large measure to inadequate training, administrative support, leadership and facilities. The result is a requirement to stop recruiting in a lucrative market.

Standard military enlistment models are deficient when predicting socio-economic impact on Reserve Force strength. They imply gender, race and ethnic relationships but emphasize economics. Econometric models rely to a large extent on variable, and often temporary, indicators such as unemployment rates. While these are particularly effective for predicting enlistments, they fail to predict, geographically, Reserve Force total strength maintenance.

As an example, Mehay,[1] 1988 indicates that the positive correlation of unemployment to enlistment rates may be offset by an additional positive correlation to attrition rates. For Reserve units in areas of high unemployment, the increase in losses probably negates (and perhaps exceeds) any increased enlistments. Economic forecasts have not proven sufficiently reliable to predict long-term Reserve strength maintenance. The economic collapse in Seattle during the 1970's and Texas in the 1980's produced no long-term impact on local Reserve strength.

Other market research for the military is still dominated by "demographic segmentation": the classification of population by age, gender, education completed and other quantitative variables. Historical USAR and ARNG membership surveys have relied on traditional "Why did you join?" or "Why will you leave?" inquiries to identify the determinants of Reserve participation. The results are then applied to develop incentives or managerial programs which, hopefully, increase enlistments and decrease attrition. While providing general insight as to Reservists' motivations and intentions, the surveys have not proven particularly helpful in reducing attrition or increasing enlistments.

The impact of society has been felt but not understood. The turbulence of individuals in Reserve units seriously affects readiness and increases training requirements and costs. Analysis has been done on the effect of attrition losses and other transfers but causes are not understood the cause of the situation. A comprehensive study must be undertaken to determine what part of turbulence is attitudinal (for example, lack of dedication, poor training and leadership), and what part is lifestyle (for example, migration, employment, family, and other interests). Perhaps more importantly, it is necessary to understand "who" is creating the turbulence. Characteristics such as gender, age, marital status and educational achievement have proven insufficient as explanatory variables.

Since the late 1970's, a different type of market research has been available. Known as "psychographics", it measures the effects of social trends on the population. The 1980 census organized virtually all American households in units called Block Groups (Enumeration Districts in rural areas). These units share the socioeconomic, demographic and housing characteristics of their neighbors. Several methods are available to cross-reference the psychographic results of lifestyle with the clustering of similar neighborhood topology.

Particularly useful with Block Group Methodology, the cultural and societal sensitivities of growing hispanic and black youth segments could be examined relative to military and civilian occupational opportunities. The location of USAR and ARNG units, and future strength maintenance, would be more assured meeting the needs of both the military and the community. In this sense, the relationship of Reserve participation requirements to family, employer, career and society responsibilities could be fully explored.

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[1] Mehay, Stephen L. (1988). Moonlighting and Reserve participation: Are they the same?, USAREC SR 88-2.

Marketing emphasis can then be given to identifying and developing niche markets using proper type and size unit mix, rather than engaging in titanic struggles over fractions in declining markets. Marketers can identify the stirrings of the population and then, working closely with force strength and location decision makers, translate this information into supportable force structure.

Innovative research, funded by USAREC and conducted by the Naval Postgraduate School has developed preliminary geographic indices for propensity (interest reflected by attitude and behavior), and competition and/or complimentation affect of other Reserve activity. Additionally, the research has developed more concise market areas for individual Army Reserve centers and National Guard armories. The standard 50 mile radius has been replaced by a variable distance which indicates geographical, political and demographic barriers reflected by current membership behavior.

The expertise of personnel involved in the USAREC studies is invaluable in developing more reliable (enhanced) models; the application of the information is vital to force location, force mix, strength maintenance, readiness and attrition concerns.

Finally, the various commands of the Reserve Components do not operate in a vacuum within the marketplace. Just as each is affected by the community, they affect each other. These proposals should be viewed as integrated and coordinated with the total force structure. In that way, it will be possible for all components to maximize strength and readiness.

Integration of models, research and data are necessary to support Reserve issues concerning force stationing, strength support, maintenance and readiness. Only in this way can the Army make informed judgments free of inconsistency and incompleteness.

Labor Markets and Economics

Economic, labor and social trends will also affect future recruiting efforts. Today, only one-fifth of workers are younger than the baby boomers; by 2000 this share will double. All of the baby-bust and much of the baby boomlet generations will be of working age by 2000 and workers under age 35 will constitute fully 38 percent of the labor force. However, the labor force will be dominated by 35 to 54 year-olds, who will constitute one-half of workers. With many pension and retirement plans not keeping pace with rising cost-of-living, the Bureau of Labor also anticipates the trend toward early retirement will end - an observation which is already limiting upward mobility for young enlistees in the Army Reserve.

Three of the four occupations expected to offer the greatest number of jobs in the coming years - retail sales, custodial, and food service - do not require an HS diploma. MOS skills, often promoted in the Reserves are "civilian-career enhancing", may not meet the continued shift from a manufacturing to a service economy. Many factory workers who depended on their manual skills to earn a good living will have to take jobs in the service sector that command little respect or money.

The major challenge of the future may not lie so much in balancing employers' needs with workers' skills, as in balancing workers' personal needs with job demands. Middle-aged reservists will need alternatives to dead-end positions in both their civilian employment and reserve careers. The continued influx of women into the work force, including the military, ensures that child- and elder-care issues will grow in importance.

The Changing Demographics

Reserve recruiting is sensitive to both the age distribution and the geographic location of the population. Due to migration, regional economic changes, immigration from abroad, and differential population growth, the age and geographic distribution of the population have changed rapidly in recent years. The prospect is that such changes will continue in the future.

The 18 - 24 year-old population of the United States is declining and will reach a low point in the 1992-1995 period. After that, the youth population will increase slightly, reaching approximately 90 percent of its 1988 level after the year 2000. Table I[2] shows the projected population changes of 18-to-24 year old males by census region. Between 1990 and 1995 the Northeast and Midwest will experience decreases of over 20 percent in the size of their youth populations, whereas the South and West will see much smaller declines. Between 1995 and 2005, all regions will see increases in their male youth population, but between 2005 and 2010, this trend will reverse and all regions will again experience a slow growth rate in this age group.

[2] Source: U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 1053 (Washington D.C.: U.S. Government Printing Office, 1990).

Table I. Percent Change of 18 to 24 Year Old Male Population for the U.S. and Regions: 1990 Base Year

Region	1995	2000	2005	2010
Northwest	-.24	.002	.07	.01
Midwest	-.20	.01	.03	.001
South	-.08	.04	.07	.01
West	-.03	.09	.10	.01

The distribution of the population and political power has shifted. From the 1990 U.S. Census, eight states, all in the Southwest and West, gained enough population to garner additional congressional seats (see Table II[3]). California, which passed New York in population in the 1960's, is the most populous state in 1990 with nearly 12 percent of the total population, the highest concentration in one state since 1860, when 12.3 percent lived in New York. Five states have population growth rates of at least 10 percent since mid-decade. From 1985 to 1990, Nevada grew by 18 percent, followed by Arizona (12 percent), Florida and New Hampshire (11 percent) and California (10 percent). In comparison, the national growth rate was only 4 percent.[4]

The 1990 census produced 33 new concentrations of 50,000 or more people, known as 'urbanized areas.' The 396 urbanized areas (UAs) defined for the 1990 census contain 158.3 million people, or 63.6 percent of the Nation's total, compared with 139.2 million or 61.4 percent in 1980.

This continuing movement of population from rural to urban areas has strong implications for Reserve unit location selection and recruiting activities. All but five of the newly designated UAs are located in the South and West. The largest new UA is the Hesperia-Apple Valley-Victorville, CA, UA with a population of 153,176. Next largest are Stuart, FL, 80,069; Lewisville, TX, 79,433; Crystal Lake, IL, 72,498; and Vacaville, CA, 71,535.[5]

The dynamics of the shifting population are most apparent when comparing the most populous states between 1940 and 1990. A shown in Table III, [6] growth in the Western and

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[3] Source: U.S. Census Bureau, "Census and You", Volume 26, No. 1, January 1991.

[4] U.S. Census Bureau, "Census and You", Volume 25, No. 3, March 1990.

[5] "New Urbanized Areas List Released", Census and You, Volume 26, No. 9, September 1991.

[6] U.S. Census Bureau, "Census and You", Bicentennial Issue, 1991, p. 11.

Table II. States Gaining and Losing Congressional Seats

Gain		Lose	
Arizona	+1	Illinois	-2
California	+7	Iowa	-1
Florida	+4	Kansas	-1
Georgia	+1	Kentucky	-1
North Carolina	+1	Louisiana	-1
Texas	+3	Massachusetts	-1
Virginia	+1	Michigan	-2
Washington	+1	Montana	-1
		New Jersey	-1
		New York	-3
		Ohio	-2
		Pennsylvania	-2
		West Virginia	-1

Southern states such as California (420 percent), Florida (over 400 percent) and Texas (265 percent) far outpaced the sluggish growth in Midwestern and Northeastern states like Ohio (157 percent), New York (133 percent), Pennsylvania (122 percent).

Table III. Ten Most Populous States: 1940 and 1990

Rank	1940	Population*	1990	Population
1	NY	13,479	CA	19,063
2	PA	9,900	NY	17,950
3	IL	7,897	TX	16,991
4	OH	6,908	FL	12,671
5	CA	6,907	PA	12,040
6	TX	6,415	IL	11,658
7	MI	5,256	OH	10,907
8	MA	4,317	MI	9,273
9	NJ	4,160	NJ	7,736
10	MO	3,785	NC	6,571

* Population in thousands

While it does not appear likely that the list of the 10 most populous states will change as rapidly in the next 30 years as it did in the late 1800's or even in the last 50 years, the historical record suggests the likelihood of some change by 2020. We can anticipate some reduction in growth in the West, particularly in California due to water scarcity, pollution, loss of defense industry jobs and high taxes. Similarly Arizona is beset by pollution and water problems. Slowdowns also have begun to occur in Louisiana, Kentucky and Texas, although establishment of the Mexico Economic Zone may reverse this trend in Texas. The East North Central States, such as Michigan and Ohio, have resumed population growth, but still at a rate less than half as fast as the nation. Based on economic and housing indicators, Utah, Washington and Georgia are good prospects for future growth.[7]

The implications of population growth and distribution are crucial to recruiting for the Reserves. Since most units must be filled by the population in the local market (generally defined as the area within a 50-mile radius of a Reserve center), the ability to support the manpower requirements of local units depends on the population supply.[8] If Reserve units fail to relocate as the population shifts, recruiting will find it difficult to maintain strength requirements in areas of slow growth and out-migration, especially given the overall decline in the military-aged market population.

Changes in the Composition of the Population

Historically, gender, racial and ethnic minorities have not been distributed equally among military occupations. As illustrated in Table IV[9], ethnic and racial minorities and women were over-represented in several Army career management fields, specifically, administration, supply, petroleum and water, and food service.[10]

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[7] Ibid.

[8] Regional trends in population, migration, and economic activity and the implications for active and reserve recruiting are discussed more fully in Michael J. Greenwood and Stephen L. Mehay, "Trends in Regional Patterns of Migration, Immigration, and Economic Activity: Implications for Army Recruiting.", Technical Report NPS-AS-91-015, Naval Postgraduate School, Monterey, CA, 1991.

[9] USAREC mini-master files, 1990.
USAR SIDPERS, 1991.

[10] Galing, Steven E., Over-representation in the U.S. Army of Minorities and Women in Career Management Fields 71, 76, 77, and 94, U.S. Army Recruiting Command, USAREC SR 91-3, May 1991, p. 28.

Table IV. Representation of Minorities and Females in Selected Army Career Management Fields (CMF) (in percent of force)

Field	USAR		AA	
	Minority	Female	Minority	Female
Army (total)	31.3	14.7	38.5	20.1
Administration	55.4	50.3	47.2	49.2
Supply	54.0	33.6	52.2	44.0
Petroleum and Water	48.5	32.4	N/A	N/A
Food Service	51.9	30.4	42.88	42.9

While it can be argued that such distribution is a measure of aptitude[11] or attitude[12] (cultural), the existence of this distribution is of considerable importance when locating certain types of Reserve units and maintaining their strength. Certainly, more research is required to fully explain the relationships between Reserve membership, unit types, and recruiting.

Today minorities constitute nearly 39 percent of the USAR membership compared with 28 percent of the nation's population. During the next twenty years, the share of minorities in the total population is projected to increase to 35 percent. An important aspect of this change is the distribution of minorities in the key growth states and urban population centers. Table IV[13] illustrates the regional distribution of the population by race for 1990.

Based on migration and the higher birthrates of Blacks and Hispanics, the minority population share in the three largest states - New York, Texas and California - is projected to exceed 50 percent by the year 2000.

[11] For a discussion of qualification by aptitude standards see Mark Eitelberg's Manpower for Military Occupations, Office of the Assistance Secretary of Defense, April 1988.

[12] For discussion see Charles C. Moskos in various publications including A Call to Civic Service, (N.Y. Free Press, 1988).

[13] Census Bureau Press Release CB91-100, March 11, 1991. (Hispanic race population distribution adjusted.)

Table V. Percent Distribution of Resident Population by Race and Hispanic Origin, for the U.S. and Regions: 1990

Region	White	Black	Hispanic	Asian	Other
United States	72.2	11.2	9.0	2.9	4.7
Northwest	76.1	10.3	7.4	2.6	3.6
Midwest	84.6	9.3	2.9	1.3	1.9
South	69.7	17.7	7.9	1.3	3.4
West	58.6	3.5	19.1	7.7	11.1

Table VI[14] presents the distribution of minority groups in the ten highest growth states. These states currently represent nearly 40 percent of the entire population and represented over 50 percent of the growth during the 1980's. Based on migration and the higher birthrates of Blacks and Hispanics, the minority population share in three key states - New York, Texas and California - is projected to exceed 50 percent by the year 2000.

Table VI. Percent Distribution and Growth of Population by Race and Hispanic Origin, for Certain States: 1990

State	% Change 1980-90	White	Black	Hispanic	Asian Other
Nevada	50.4	74.9	5.6	10.4	3.2 5.9
Arizona	34.9	71.9	1.5	18.8	1.5 6.3
Florida	32.8	72.1	12.4	12.2	1.2 2.1
California	25.7	56.8	5.8	25.8	9.6 2.0
New Hampshire	20.5	97.2	0.5	1.0	0.8 0.5
Texas	19.4	59.4	10.1	25.5	1.9 3.1
Georgia	18.6	69.4	26.8	1.7	1.2 0.9
Utah	17.9	88.7	0.5	4.9	1.9 4.0
Washington	17.8	84.5	2.7	4.4	4.3 4.1
New Mexico	16.6	50.0	1.5	38.2	0.9 9.4

[14] Census Bureau Press Release CB91-100. (Hispanic race population distribution adjusted.)

Hispanics represent the fastest growing segment within the positive growth potential sections of the country (Florida, Texas and California). However, they are generally under-represented in the Army Reserve. This may be as much a result of opportunity, that is, proportionally fewer Reserve units are located in areas of high Hispanic population markets, as it is the propensity for Reserve military service. The only purpose here is to recognize that Hispanics represent a potential recruiting market of considerable importance in coming decades.

Research conducted by Mark Eitelberg and others clearly demonstrate that racial distributions are unequal across military occupational specialties. Reserve recruiting must be particularly sensitive to this reality since the local population is the primary source of Reserve membership. The tables above suggest that specific Reserve units are unlikely to be "representative" of the national population. Such representation is not possible when local areas do not contain the same elements, in the same proportions, as are found in the national population.[15] [16]

Education and Quality

During the past four decades, demographic changes have profoundly affected American education. At the elementary and secondary level, enrollments increased in the 1950's and 1960's due to the baby boom, and declined in the 1970's as birth rates fell. Declines continued into the early 1980's, followed by slight increases in the late 1980's. Table VII[17] presents actual school enrollments through 1985 and projected enrollments through 2000. As Table VIII indicates, the actual number of high school graduates will continue to decrease through the year 2000. Likewise, college enrollments peaked in the mid-1980's, remained stable for a few years and are slowing declining.[18] However, unlike secondary education, the passing of the "baby bust" generation will cause college enrollments to decline until the late 1990's. It is interesting to note that women now comprise more than 50 percent of college enrollments.

For military recruiting purposes, quality shares importance with volume. The declining enrollments are coupled to decreased gradation rates and increased numbers of alternative graduate diplomas such as the GED, which is not recognized as a HSDG for enlistment. As Table VIII[19] illustrates, the percent of population actually graduating is declining.

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[15] Eitelberg, Mark J., "Military Representations, Reflections and Random Observations", A paper presented at the Biennial Conference of the Inter-University Seminar on Armed Forces and Society, Baltimore, MD., October, 1989, p. 3, 16.

[16] Hispanic race population distribution adjusted.

[17] U.S. Department of Education, Center for Education Statistics, "Projection of Education Statistics", Sept 1988.

[18] U.S. Department of Education, "Projections of Education Statistics to 1997-98", Office of Education Research and Improvement, National Center for Education Statistics, Publication CS 88-607, (Washington D.C.), September 1988, p. 5.

[19] U.S. Department of Education, National Center for Education Statistics, "Digest of Education Statistics", September 1990 and "Projections of Education Statistics", September 1990

Table VII. Enrollment in Secondary and College Institutions: 1975 to 2000 (in thousands)

Year	9-12	4-Year	2-Year
1975	14,304	7,215	3,970
1980	13,313	7,571	4,526
1985	12,460	7,716	4,531
1990	11,386	7,669	4,615
1995	12,704	7,306	4,450
2000	13,859	7,488	4,596

Likewise, as a percent of the total population, students electing alternative education such as the GED increased from 6 percent of the graduate population in 1975 to over 9 percent in 1990. Surprisingly, the same statistics show a decline in drop-out rates from 17 percent in 1970 to 11.9 percent in 1990. This occurs across all race and gender spectrums.[20] It appears that more young people are being disenfranchised from the education system and not even enrolling for secondary education; thus fewer graduate but the official dropout rate of enrollers declines. If this trend were to continue, the demographics of lower population coupled with even lower availability of "quality" young people for recruiting will result in requirements for lower standards or fewer enlistments. For the AA, the specter of fewer enlistment requirements due to force reductions will allow continued recruiting of the highest quality. For the Reserves, the possibility of continued high requirements, coupled with higher attrition could spell disaster.

When we consider that in some communities over 40 percent of black youth fail to graduate from high school, the local effect is that military available (MA) population could be reduced as much as 35 percent when calculating qualified military available (QMA) population.[21]

[20] Ibid., p. 99.

[21] Youth Indicators 1988: Trends in the Well-Being of American Youth, U.S. Department of Education, National Center for Education Statistics, Washington D.C., pp. 20-21.

Table VIII. HS Graduation and GED Attainment rates: 1970 to 1995 (in thousands)

Year	Population of Year	Number of 17-Olds	Graduates' Percent of Graduates	GEDs Issued Grads Population	GEDs Issued Grads 17-24 old	% of 17-24 w/GED
1970		3,757	2,889	76.9	N/A	---
1975		4,272	3,148	73.7	201	6.0
1980		4,207	3,020	71.8	286	8.6
1985		3,691	2,642	71.5	251	8.7
1990		3,375	2,475	71.2	248	9.1
1995		3,501	2,393	68.4		

The implications for the quality recruiting (HSDG) and "college bound" market are clear.[22] While the trend is slowing, it is not anticipated that high school diploma rates will rise in the near future and, the evidence attributing graduation completion rates to more alternative schools with "diplomas" not recognized by USAREC is compelling.[23] The result is a declining QMA well past the year 2000.

Management of Reserve accessions

After discussing the need for Reserve forces and the labor market that feeds recruiting, we show how Reserve accessions is managed and the constraints under which it operates.

[22] For a comprehensive discussion of the relationship of family unit, race, and income to educational achievements, see Digest of Education Statistics 1990 and Youth Indicators 1988: Trends in the Well-Being of American Youth, U.S. Department of Education, National Center for Education Statistics, Washington D.C.

[23] For example, U.S. Department of Education statistics show the number of high school graduates declined from 73 percent in 1975 to 71 percent in 1985. Included in graduates are GED certificate awardees which increased 150 percent in the same time period.

Current Army Reserve and Army National Guard recruiting and assignment policies require that the primary source of unit members be located within the center/armory "market areas". For the Army Reserve, market areas include all of the population within a 50-mile radius of a Reserve center. Successful recruiting requires the existence of an adequate population pool in the market area to meet requirements for specific MOSs. Existing Reserve recruiting and marketing strategies require sophisticated models to predict supportable levels of specific MOS strength levels by geographic (market) location. Such models could then provide a significant contribution to Reserve recruiting goals, unit readiness, force mix and unit location decisions.

The latest Reserve end-strength and military budget constraints will severely test the ability to recruit for Reserve forces. Most major commands have begun to intensively manage unit vacancies and proscribe enlistment authority. "On demand" enlistments which often added non-required (overstrength) unit vacancies for specific individuals, not otherwise qualified or interested in existing vacancies, have been eliminated.

These policy changes focus attention on MOS-specific recruiting requirements. It is conceivable that a reserve recruiter may be required to reject several otherwise qualified applicants to locate one who meets all the enlistment requirements and is willing to accept the specific MOS vacancy available at the local Reserve unit. Concern exists that some markets may be inadequate to recruit satisfactory numbers of enlistments for specific MOSs. These locations must be geographically identified and the level(s) of specific MOS supportability quantified.

The current recruiting philosophy assumes that young adults will accept a variety of MOS to qualify for the benefits of Reserve membership, and that an acceptable MOS will be available at all locations. However, unlike the AA, the USAR can only recruit for those unit vacancies that exist in the immediate market area. The lack of training opportunities (MOS mix) often places the applicant and recruiter in a "take it or leave it" situation. The motivation to enlist may be a response to incentives rather than dedication, and when the incentive is exhausted, the member attrites. The actual percentage of the otherwise eligible population in each market, that has the interest and meets all the eligibility criteria for a specific MOS, is not known at this time.

Many Reserve units have significant requirements for specific MOSs in low grade structures which must be filled by NPS enlistments. Examples include the highly skilled MOS 91C (medical corpsman) in medical units and 71L (clerk-typist) in administrative and personnel units. Achievement of recruiting goals is based on meeting MOS-specific requirements. Unfortunately, these units have not been identified, nor have the available markets been evaluated, for specific geographic recruiting supportability.

Some alternatives have been proposed and selectively implemented to meet USAR MOS-specific recruiting needs. PS individuals with critical and "hard-to-fill" MOSs are being assigned to units with shortfalls regardless of geographic location and the individual attached to the closest unit for training in basic soldier skills. Other Reserve units have expanded their market areas by creating "sections" and "detachments" (some unofficially) at distant geographic locations.

Other alternatives are available. These include (1) relocating selected units or sub-units; (2) attaching critical skill reservists to the nearest USAR center for administrative authority with assignment to another unit which requires the skill, called a unit mobilization augmentation (UMA); (3) providing alternative training opportunities or requirements at the unit level, drilling individual mobilization augmentation, (DIMA); or (4) authorization for overstrength authorizations of critical MOSs at unit locations with adequate markets. Those individuals recruited via policy (4), above, would be identified for specific mobilization backfill at units with shortfalls. Necessarily, units with overstrength or attached personnel would require additional resources to provide administrative, training and logistical support.[24]

Market Area

Various distance dimensions of markets have been used by USAREC. The current market supportability models use an adjusted MA population to a uniform 50 mile radius for each USAR and ARNG location. Previous studies indicate that this does not reflect the actual time/distance patterns of membership, particularly with consideration for transportation networks and geographic barriers[25]. In the past, radii of 15, 25 and 35 miles have been used to define the USAR market area, with 35 miles being the most common. A funded USAREC USAR research project conducted by the Naval Postgraduate School quantified local distance weighting factors. However, the results were never integrated in the market supportability models.

Successful recruiting for the Reserve Forces is critical to meet national defense strategy, readiness and mobilization expectations. These goals are achieved only when reserve unit members are recruited consistent with the local unit manpower requirements for specific military occupational specialties.

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[24] Army Reserve Special Report 1991, Office Chief of Army Reserve, May 1991, p 15.

[25] U.S. Naval Postgraduate School Briefing, 3/88.

Data Validity and Availability

After covering many aspects affecting the USAREC environment, it is appropriate to discuss the analytic conditions under which researchers operate.

The force structure of the Army is particularly critical in that the USAR and ARNG comprise over 50 percent of total Army assets. The Total Army Analysis develops the Army's force mix and mission assignments. Currently, there is no standard model, methodology or format for decision makers involved in the annual TAA, or subsequent Troop Action Guidance (TAG) or Troop Action Program (TAP) activities.

Three separate commands within the USAR develop force support/sustainment models. The Office or the Chief, Army Reserve (OCAR) and other Department of the Army (DA) level agencies utilize the FORECAST and other DA systems for strength projections. United States Army Reserve Command (USARC) utilizes the an independent system for their end strength projections and identification of recruiting requirements. The USAREC market supportability (force location) studies for USAR TPUs and USAR missioning are currently in a state of disarray since their data sources have been disrupted. Even the current manpower requirements differ in various models, using continental USA authorized, VTAADS wartime required, "enhanced/overstrength" required or other end strength estimates.

The ARNG has an even more complex system involving the 54 states and territories plus the National Guard Bureau. Organizational and personnel data is not easily accessible by Army Reserve decision makers. For example, the USAREC-USAR data on Guard TPU locations and strength requirements, necessary to develop competition indices, is over four years old. Updates are sporadic and often require validation. The National Guard Bureau, in its own force location models, often relies on state data rather than DA source files.

Models, when they exist, often lack a consistency of data input and interpretation and have seldom been validated. Population projections for future growth have differing characteristics (particularly age and education level factors) and units of observation. None of the models provides estimations of actual Reserve strength growth potential; rather the analysis is based on assumptions of current strength with limited changing market conditions. The result is a zero-sum, no-growth estimate.

Task 1. Literature Search

Literature Reviewed

Barnes, J. (1991). USAR recruiter zone analysis enhancement study, Alexandria, VA: HumRRO International, Inc., DFR91-15.

Brockett, P.L., et al (1995). Final Report: Feasibility study of a FAARA-SHARE methodology for the U.S. Army Reserve, Austin, TX: Center for Cybernetic Studies. The University of Texas, December 1995.

Gorman, Linda and Mehay, Stephen (1989). Estimating local area propensity for the USAR: A feasibility analysis, U.S. Naval Postgraduate School (NPGS).

Kang, K. et al (1994). Analysis of unit costing at USAREC, NPGS.

McWhite, Peter, et al (1995). Cost benefit study of recruiting prior service enlisted reserve personnel, Rockville, MD: McWhite Scientific.

Mehay, Stephen L. (1988). Moonlighting and Reserve participation: Are they the same?, USAREC SR 88-2.

Mehay, Stephen L. (1989). An enlistment supply and forecasting model for the U.S. Army Reserve, USAREC SR 89-2.

Reserve components: Factors related to personnel attrition in the Selected Reserve, (1991) U.S. General Accounting Office, GAO/NSIAD-91-135.

Tan, Hong W. (1991). Non-prior service reserve enlistments, Santa Monica, CA: RAND, R-3786-FMP/RA.

Thomas, G.W. and Swibies, G.M. (1988). The historical development of the USAREC's national market analysis (NMA) troop action program (TAP), USAREC.

Wegner, Robert G. (1991). Rational expectations Army recruiting model (REARM), USAREC SR 91-7.

We also reviewed the NPGS study, *Modeling Distance to Work Behavior* by Laura D. Johnson and George W. Thomas (December 1988), on USAR membership distance. We discussed the data analysis effort with Susan Olson, the technical analyst of this study. We then reviewed copies of the data. We gained a critical understanding of the problems in using a standard 50-mile radius of USAR centers as the defined geographical membership area.

Literature Search Report

We were unable to use directly any of the above published USAR studies for information on:

- **Time to Recruit**. The time and resources required to recruit[26] an NPS or a PS civil life individual or transfer[27] an Individual Ready Reserve (IRR) soldier to a USAR TPU.
- **Distance/time.** The propensity of either potential NPS applicants or IRR transferees to accept various commuting times or distances. In Task 3 we will explain why we were unable to use the NPGS distance study.
- **Demographic Propensity.** The propensity of various demographic groups to volunteer for the USAR.

At study onset we concluded that estimating time-to-recruit was feasible but that resources would not be sufficient to rigorously determine *recruits' distance and time* or *demographic propensity*.

Task 2. Collect data

Data Retrieval Efforts

We have explored the following data concerns. It is instructive to have an appreciation of how the reference files(s) are built. Our primary file is the MKTAVA50 file. It contains data to identify the current and 5 year projected military MA population within a 50-mile radius of the ZIP code locations of USAR TPUs and ARNG units. MA populations within those market areas which overlap other USAR or ARNG locations are pro-rated and adjusted based on the distance of each market ZIP code from the center ZIP code. The supply (adjusted MA) for each location is specific, unique and independent of the supply for all other locations.

[26] The IRR is composed of former active duty (AD) soldiers who have a Service obligation. USAREC and other organizations *transfer soldiers among Army components* from the IRR to the Selected Reserves. PS civil life individuals are former AD soldiers whose 8 year Service obligation has expired. These former soldiers, like NPS candidates, have no military status so they are *recruited* and accessed to the Selected Reserves.

[27] There was some cost information in *McWhite, Peter, et al,* above, but it was not sufficient for this study's needs.

Overlapping Market ZIP Code Areas

Over 3000 of 40,000 ZIP codes have USAR and/or ARNG units located in them. The MKTAVA50 file is built as follows:

- (1) Identify ZIP codes within a 50 mile radius of each ZIP code.
- (2) Compute a weighted factor of the distance for each ZIP code combination and, when a ZIP code is shared by other ZIP codes, compute the percentage factor the distance represents and
- (3) Multiply the weighted factor against the total MA populations for each market ZIP code.

Effectively the total of the adjusted MA equals the total MA population within 50 miles of all USAR and ARNG units.

We have the following concerns about the MKTAVA50 file:

1. It assumes that the USAR and ARNG have an equal population draw.
2. It assumes a fixed draw over 50 miles. Studies have shown differences among TPU type, NPS/PS, gender and grade. The range of membership (home ZIP codes) distance of 95% of current members (3 and 5 year cohort groups) is from 7 to over 200 miles.
3. It does not consider geographic barriers and different transportation systems.
4. Its TPU-centered definition of market does not consider the RS locations which is an average of over 20 miles from the TPU.

Density Definitions Relative to Recruiting

Density of MA can be defined as:

- MA over the square miles of territory.
- MA over vacancies or enlistments.
- MA over TPU strength (authorized, required, or assigned).

We attempted to verify these density measures by running regressions on each population measure at the station, company, and battalion level against percentage fill with the hope that there would be some measure that could describe the density needed for a successful unit. However, none were successful. We discuss this further in our Task 3 report. It appears that it is not possible to recruit proportionally for all representative TPU's.

Market Population

The Woods & Poole (Census) data do not differentiate between HSDG and GED, home school, etc. From 1970 to 1990 there was a decline in HS graduation rates and an increase in alternative HS education. Interestingly there was a decline in drop-out rates over the same period.

We see examples where the population demographics as expressed by MA give misleading indication of qualified and interested (QMA&I) market. USAR recruiting in San Diego is an example. There, about 2/3 of the MA population cannot make Armed Services Vocational Aptitude Battery (ASVAB) scores high enough to enter any MOS.

USAREC has used the total male population ages 17-29 with no adjustments for regional variations of mental, medical qualifications or interest in joining the military. We suggest that measures of QMA are needed for this and other models and for market supportability, national market analysis, recruiter zone analysis and missioning. To obtain QMA estimates, the gender and age-specific HSDG MA is adjusted for regional mental, moral, and medical qualification rates as well as regional propensity yielding HSDG QMA&I.

Test Score Category (TSC) can be estimated by age, parents' education and family income. Currently USAREC assumes 100% medical & moral qualification rates yet studies show a greater than 20% disqualification rate for medical and moral conditions for 16-24 year olds. A further need for QMA is the gender and racial over-representation in some MOS but correspondingly lower in others. This affects TPUs with their specific MOS requirements since nearly 39% of USAR members are minorities compared to 28% in the general population. By region, minority percentage ranges from 15 to 41%.

Data Summary

Using QMA instead of MA would give a much more accurate measurement of available population. When prorated to USAR centers *only*, with appropriate consideration for distance and geographic restrictions, one could possibly develop "density" ratios with meaningful correlations to recruiting mission success at the station-level.

Data Retrieved

The data delivered for development of the ORRM included: USAREC data included Military Enlistment Processing Station (MEPS) conversion rates (physical, mental, enlistment) and USAR mission configured to current recruiting battalion (Rctg Bn) boundaries.

We retrieved USAREC and FORSTARS data files and index for review of current postings.

> Population Data - Current population estimates from Woods and Poole based on 1990 U.S. Census. Data were aggregated from the ZIP code-level unit of observation.

Primary population is 17-21 year old population, **Secondary** population is 22-29 year old population.

Vacancy Data - We assume that current vacancies are posted as of 31 October 1995 for all USAR units. **NPS** vacancies are all vacancies in enlisted pay grades E-1 through E-3; **PS** vacancies are all vacancies in pay grades E-4 through E-9.[28]

Strength Data - Most recent USAR and ARNG unit strength data. USAR data is as of July 1995. ARNG data is as of February 1995. Data consists of enlisted required (wartime strength), authorized (peacetime funded), and assigned strength.

Production Data - Summary of FY95 enlisted from the USARC ARECRUITFY95 file (Litton). **NPS and PS** enlistments based on field RPSNPS. Count does not include in-service transfers from Active duty, officers, ARPERCEN IRR assignments, or transfers between USAR units. The PRODCROS file details cross-boundary enlistments (Bn only) defined as variances between the residence (home) ZIP code of an enlistee and the center ZIP code of the USAR TPU assigned.

We obtained, by ZIP code and associated RSID, the number of E1-3 (NPS) and E4+ (PS) TPU members, the NPS and PS losses, the authorizations - losses, and the male and female 17-21 and 22-29 year old populations. We updated these data to reflect the recent realignment of TPUs and recruiting stations. Losses from the above ZIP codes have been corrected by subtracting the losses due to closed TPUs.

We had received recruiter productivity data from USAREC PA&E, but found that they were missing production data from hundreds of RS. In their place we used data from the FORSTARS Recruit File.

Correcting Data

There were some ZIP codes where the number of (primarily E1-3) members were higher than would correspond to experienced recruiters' perceptions' of recruiting propensities. We determined that these ZIP codes are at major universities that have drawn TPU transferees from beyond their ZIP code's area. These members apparently joined the USAR at *home*, before enrolling at their university.

[28] We found that TPU members data had a higher correlation with NPS and PS accession production if they were based on E-1 to E-3 as NPS rather than E-1 to E-4.

We corrected these data by removing members who had a transfer. (Study resource constraints prevented us from determining where each NPS member joined the USAR.) However, it appears that E1-3 are unlikely to transfer among units within the local area. Thus we will assume that all transfers among E1-3 are transfers between their home, where they joined the USAR, and their schools and associated ZIP codes. Therefore we will assume that all transferees have transferred from their home, and are thus not representative of the members who joined the USAR from their current ZIP code. We will simply delete all transferees from our *members* data.

Data Sources

We made the following assumptions in developing Table IX:[29]

> Data values are assigned to the USAREC Rctg Bn/Company which is assigned the ZIP code associated with the address ZIP code of the USAR center or ARNG armory, the residence (home) ZIP code of the enlistee, or the ZIP code of the population inventory. Assigned ZIP codes are based on the Litton/USAREC ZIPINFO File maintained by USAREC and define the recruiting unit-of-observation boundaries and territory.
>
> Values for population, area, and ARNG unit strength include **only** those ZIP codes within 50 miles of a currently existing USAR center as indicated on the Litton file MKTAVA50. ZIP codes beyond 50 miles of USAR centers are assumed to be not within the market for USAR recruiting and are excluded.

[29] Data are provided in both ANSI file (type SDF) of original data (fixed format) as <name>.DAT and in dBase file format as <name>.DBF.

Table IX. Data Sources

Variable	Source and Time Period
Enlistments	ARECRUITFY95 Files (FORSTARS)
Vacancies	VACANCY Files (FORSTARS-Litton)
Distance	RS-RC: MKTAVA50 File (USAR-Litton)
ZIP Area	MARKET File (USAR-Litton)
BN ZIP Code	ZIPINFO File (USAR-Litton)
BN Boundary	ZIPINFO File (USAR-Litton)
Population	MARKET File (USAR-Litton)
	WOODPOOL File (USAR-Litton)
Competition	ARNGSTR File (USAR-Litton)
	ARNGLOC File (USAR-Litton)
USAR Unit	USARLOC File (USAR-LITTON)
	USARSTR File (USAR-LITTON)

TPU Structure Changes & Recruit 2000 Affect Data

This study's Statement of Task (SOT) directed development of an ORRM at the RS-level. This was later modified to require analysis at the ZIP code-level. At this level we were tasked to investigate recruiting effects of:

- USAR and AA recruiter mix.
- Recruiter characteristics.
- Large vs. small stations.
- Number of USAR and of AA recruiters
- Number of AA recruiters.

During 1993-94 many USAR TPUs were either closed or transferred to the ARNG. This precluded the consistent time series data needed to analyze the above effects. Data were also affected because USAREC instituted Recruit 2000. This policy assigned a USAR (as well as a AA) mission to an entire RS, rather than to individual recruiters. Consequently we could not analyze any of the above effects.

Density Measures and Recruiting Performance Prediction

We were also tasked to investigate the effects of population density on enlistments. We found that at the ZIP code-level the population density correlated with enlistments only at the .18 level. In the set of RS in Table X, note that the number of enlistments in the upper and lower groups of RS/ZIP codes are about the same. However the lower three ZIP codes have population and MA densities about a factor of ten *lower* than the densities of the upper group. As would be expected from density's low correlation with enlistments, the above counter example shows that density is an unreliable predictor of enlistments at the ZIP code-level.

An RS is assigned vacancies only from TPUs within a 50 mile radius. This limits a recruiters' average driving time such that it conforms to a nominal 1/2 hours to/from a candidate's home. Consequently density measures have reduced importance.

Table X. Density Measures at Selected RSIDs Do Not Correlate

	MEMBERS		LOSSES		ENLISTMENTS			RECRUITERS		RECRUITS			MIL AVAL		POPULATION			DENS_POP		DENS_MA	
RSID ZIP	E1-3	E4-9	E1-3	E4-9	E1-3	E4-9	N	/ZIP	CUMM	NPS	P	DELTA	17M	22M	17-21	22-29	AREA	N	P	N	P
1A1D 12203	7	9	0	3	1	3	1.6	0.1	0.6	12	3.0	2.0	429	458	1358	1454	12	114	122	36	38
1A1D 12206	6	7	1	5	2	0	1.4	0.1	0.7	13	2.4	2.7	254	261	884	903	2	455	465	131	134
1A1D 12208	6	3	1	2	1	3	1.4	0.1	0.8	15	1.0	2.2	310	307	995	984	5	207	204	64	64
1A3J 12953	6	21	1	2	2	2	2.0	0.1	2.0	37	4.0	33.9	293	265	375	339	200	2	2	1	1
1A3P 12901	9	36	2	23	3	15	2.7	0.1	2.1	39	16	11.9	329	376	1516	1735	70	22	25	5	5
1A3P 12972	4	6	1	5	2	2	1.2	0.1	2.2	41	2.6	2.2	40	28	230	162	81	3	2	0	0

Task 3. Estimation of Recruiting Battalion USAR Production

Production-related Data Analysis and Critique

TPU Distance Analysis Needed, But Not Possible in this Study

The NPGS Distance to Work Study would appear applicable to this study. However the following paragraphs will show why it cannot be used.

Using the NPGS study one can determine the boundaries of the 95th percentile of the MA population for a given TPU by using the distance from the TPU to its ZIP code, the TPU's grade and MOS structure, plus MA population. The TPU's MA population area will be as small as several miles for an urban unit and up to 150 miles for some western TPU's. This range suggests that the *50 mile limit* used in developing the NPGS study is unreasonable.

For several years a study has been proposed that would apply the above data to TPUs and the ZIP codes that constitute each RS. This effort would incorporate building a reference file that defined the location of each TPU and included its MOS and grade structure. An iterative effort would determine the applicable MA population, then the population within the 95th percentile boundaries of each TPU. Geographic barriers would be incorporated. The effort is clearly be beyond the resources of this Study.

In summary we cannot use the NPGS study because:

- There are not sufficient resources to, in effect, conduct the above-described development of TPU-to-ZIP code distance relationships.
- The 50 mile limit is unreasonable.

MA Population and Associated Density & Propensity Not Sufficiently Accurate

In the previous section we provided an extensive discussion about why using the MA population is not sufficiently accurate for this study. In brief, the MA data did not correlate with recruiting success at the RS, company or Bn level. We believe that to be suitable, the MA data must incorporate measures that estimate the QMA&I market. These data would adjust gender and age-specific HSDG MA for regional mental, moral and medical qualification rates as well as regional propensity, yielding HSDG QMA&I.

Although USAREC has maintained QMA&I data in the past, it does not maintain it currently. Even if our study resources permitted QMA&I development, it would be unreasonable to design the ORRM to require these data as its maintenance would severely burden USAREC ORRM operators (and it likely would not be maintained, rendering the ORRM unusable).

With MA and associated density measures not usable for estimating recruiting cost, and QMA&I not practical to use, it became necessary to find a suitable proxy for the information contained in variables such as population density, mix and propensity. The following describes a proxy which we believe is comparable with, and will require less effort for USAREC to maintain, then the above variables.

Research Determines Excellent Proxy for MA, TPU Distance and Density Measures

As directed by USAREC this study must develop data that can order ZIP codes by NPS and PS potential productivity. As discussed above, ordering by MA or QMA fails because it does not incorporate:

- Geographical barriers
- The types of people who would not join, such as
  - -- Runaways and hippies
  - -- Affluent suburban youngsters
- Distances less than or greater than 50 miles
  - -- Urban and suburban areas
- Population eligibility and interest in vacancies
  - -- San Diego has only medical and psychological warfare TPUs.

As will be discussed later, we used each ZIP code's E1-3 and E4+ members as a proxy for the above MA densities. Our methodology:

- Normalizes vacancies by the number of NPS and PS members.
- Uses *membership-adjusted vacancies* which become the upper limit for a ZIP code's potential mission.
- Avoids recruiting effort in high population areas that have few current vacancies.
- Encourages more effort in areas with low population, but many vacancies.
- Supports ordering ZIP codes by their *membership-adjusted vacancies*, which ranks ZIP codes from most to least productive.

Recruiting Effort

Delphi Interviews

We conducted delphi interviews with: the San Diego (SD) Military Enlistment Processing Station (MEPS), the N. SD RS, Poway RS (SD), Antioc RS (W. San Francisco Bay suburbs), Sacramento Rctg Bn, Chicago Rctg Bn, Chicago MEPS, and the Baltimore Rctg Bn.

We conducted Delphi interviews with Portland Rctg Bn USAR personnel including the operations officer, operations NCO, MEPS counselor, and three experienced field recruiters.

These interviews found four primary factors affecting recruiter time-to-process an NPS candidate through acceptance of a USAR contract:

- Number and variety of TPU vacancies. This is essentially equivalent to the variety of MOS in the area TPUs' structure. NPS billets, of course, have to be E-1 to E-4 as opposed to the PS E-5+ Combat Arms billets in training units.
- Nominal AFQT performance in an area. This tends to become an urban or suburban reading skills discriminator with (for example) an urban immigrant population testing poorly but often readily accepting offered MOS training. Suburban candidates tended to be very discriminating, regardless of AFQT performance.
- Distance to TPUs. This is related to the TPU vacancies factor. Urban candidates were said to be less willing than their suburban counterparts to travel long distances to a TPU, often because of lack of a driver's license.
- Population density and number of high schools in area. This is related to AFQT performance.

Portland Bn Recruiter Effort

Table XI summarizes information provided by Portland Bn USAR recruiters:

Table XI. Portland Area Recruiters' Monthly Task Times (hours)

ACTIVITY	NPS	PS	IRR	OTHER	TOTAL
Prospecting	55	0	17		72
Interviewing	16	10	1		27
Processing	11	10	8		29
Teaching				16	16
TPU liaison, Admin, Military				38	38
TOTALS	82	20	26	54	182

Comments on Table XI:

a. The total of 182 hours is consistent with the extra 1 or 2 weekend days USAR recruiters spend at their USAR units, conducting tasks such as escorting new members as well as establishing credibility, learning of vacancies not yet posted and soliciting referrals.

b. Prospecting for IRR is requires about 17 hours per month, primarily preparing mailings from lead lists and responding to telephone calls from prospective IRR transfer candidates.

c. MEPS and Packet preparation times for NPS and PS civil life are estimated at 4-5 hours for forms, 1.5 hours for ASVAB testing, 1.5 hours for a physical, and 3.5 hours for enlistment activities.

d. Telephone calls are the primary NPS prospecting effort. It takes 40 to 50 contacts (3 hours of phone work each day for 2 weeks) to bring about interviews with eight prospects. Interviews average 2 hours each and eight interviews eventually yield one NPS enlistment.

e. The "Other" prospecting time includes circulating in areas frequented by high school students, visiting schools during and after hours, career fairs, and coordinating functions or otherwise *showing the uniform.* Recruiters will solicit referrals and pass out literature and business cards.

f. USAREC generally prospects for IRR transferres using cards or letters based on lead lists. Many will not need another ASVAB or physical examination. Both reasons account for IRR production being substantially faster than for NPS. A RAND study on PS enlistments stated a recruiter production effort tradeoff of three or four to one for PS versus NPS. This is consistent with data presented here.

g. The cited RAND study did not distinguish between PS civil life and IRR. The PS civil life former soldiers[30] must undergo the same processing as an NPS. However they do not require prospecting since most are walk ins.

g. Portland mission performance averages 1.5 NPS and 2 PS per month.

The Portland estimates provided excellent background for the recruiting time analysis that follows.

NPS Recruiting Resources Time Study

This time study was based on actual measurements, consensus estimates, logical lower or upper limits on processes, and a need for a plausible relationship with actual recruiter force annual production. It recognizes that geographical and organization constraints effect a cap on process times.

Recruiter driving or *windshield* times were not amenable to direct measurements because there is such a great variety of location combinations for candidates, RS, METS, MEPS and TPU. We determined windshield times by seeking consensus on bounds for these times, realizing that extreme times would not exist because commercial transport would be used. We believe that our windshield time estimates avoid the bias that could result from using unrepresentative samples.

Background and Introduction to Time Study

In FY95 1320 USAREC recruiters assessed 18,848 FY95 NPS recruits. Assuming that recruiters work 46 weeks of 52 hours each and using the ratio of NPS recruiting time to total time of .45 from Table XI, we have 75 recruiter-hours per NPS recruit.[31] The Portland production level is only 80% of the IRR Transfer CBA Study's[32] 93.5 hours per NPS recruit. However the CBA Study did not include 54 hours of recruiter overhead or "Other" that are in Table XI. Had this overhead been incorporated in the CBA Study its productively would have been about 20 hours lower or 73.5 hours per recruit, virtually the same as the Portland estimate.

The following sub sections are a detailed recruiting task analysis, as opposed to the aggregate analysis in the CBA Study and the Portland hybrid aggregate/task analysis.

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[30] PS civil life includes former members of other Services. Regardless of their military status they must be accessed into the Army.

[31] Assuming that recruiters work a 46 week year.

[32] McWhite, P., et al. 1995.

NPS Recruit Prospecting Hours

Recruiters had claimed that they spend 5 hours each day prospecting for leads; however, our observations suggested only somewhat more than 4 hours. From Table XI, about 75 percent of prospecting time is for NPS candidates, so we estimated that recruiters utilized 3 hours each day for NPS prospecting. With 46 working weeks per year, the Table XII total is consistent with 3 hrs./day for NPS recruiting.

Table XII. Recruiter Annual NPS Prospecting Efforts

	Hours
Telephone	150+
Street & School	330
Delayed Entry Program*	220
Total:	690

** Unlike Active Army recruiting, the USAR does not have a Delayed Entry Program (DEP). However Recruit 2000 responsibilities require that USAR recruiters spend time with their station's DEP pool. This association can provide USAR leads.*

Recruiters estimated that 50-60 prospects[33] produce five applicants who will meet interview appointments at the RS.

"Conduct" Interview Hours per Recruit

Conduct interviews are held at either the prospect's home or the RS. Each interview requires about 45 minutes plus about 20 minutes to conduct a practice ASVAB and schedule the actual ASVAB.

The five prospects receive 5 hours of interviews plus 3 hours windshield time for driving to a prospect's home. These 8 hours yield three candidates who have passed the practice ASVAB and are cleared to take the ASVAB.

Take ASVAB

The ASVAB is administered either at a MEPS or a nearby military enlistment testing station (METS). Recruiters indicated that 2 out of 3 candidates who take the ASVAB will pass it. It takes less than 2 hours of recruiter time for each candidate. The 4^{+} hours are an average that accounts for the time it takes some recruiters to drive candidates to an ASVAB test site.

[33] Note our restrictive definition of *prospect* stated after Table XIV.

Do Packet

Completing the enlistment packet, comprising about 15 pages, requires about 2 hours for each candidate. For the two candidates who passed the ASVAB, the net time is 4 hours.

MEPS Visit

The MEPS visit comprises a morning physical exam followed by an MOS selection session with a guidance counselor. If both are successful, the candidate is enlisted. Recruiters will always escort candidates to and from a MEPS when within driving distance. Otherwise candidates will receive a bus or airline ticket to the MEPS. Recruiters reduce the impact of spending a full day at a MEPS site by:

- Sharing candidate escort duties with AA recruiters.
- Conducting telephone prospecting when a desk is available.[34]
- Returning to the RS between candidate drop off and pickup.

In many instances recruiters must extend their workday well beyond a nominal 9+ hours to make, for example, a 07:30 MEPS check-in. However we did not include these excessive hours in our analysis because they do not represent constrained resources that could affect recruiter productivity[35] or be reallocated. This leads to another bound on the candidate transport time estimates.

We observed that about 2/3 of candidates are within driving distance of a MEPS and can be escorted by a recruiter. Our time estimate for these candidates considered the above-listed ways recruiters use to cover candidates' MEPS visits. We did not count recruiter's very early or late hours. The candidates who are distant from a MEPS must use air or bus transport, but a recruiter will be escort them to their station. Averaging over all candidate locations we estimate USAR recruiter time of 6 hours per MEPS visit. Our two candidates will require 12 recruiter-hours for their MEPS visits. One of the two candidates will enlist in the USAR and be assigned to a TPU.

TPU Visit.

A USAR recruiter will escort the new recruit to either a TPU drill or to the RC for initial processing. We concur with 4 hours recruiter time for each TPU visit that the USAREC IRR to TPU CBA[36] Study reported.

The recruit will then await basic training (BT) and advanced individual training (AIT), while drilling with a TPU. This period is called the delayed training program (DTP). Since many NPS recruits are high school seniors or in college, the DTP permits them to delay training until the summer.

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[34] This is an *ad hoc* procedure: MEPS telephone lines and desk space are limited.

[35] Having a lesser transport time would not result in increased productivity.

[36] ibid.

NPS Recruiting Time Estimates: Prospect to TPU Member

The CBA Study and Portland estimates helped validate the following, more detailed, recruiting resource analysis. Table XIII summarizes our results.

Table XIII. NPS Recruiting Times

Action	Number of Candidates	Time per candidate (hrs.)	Outcome	Time Required (hrs.)
Prospecting	50-60		5 Interview Appointments	48.3
"Conduct" Interview	5	1+	3 Take ASVAB	8
Take ASVAB	3	2-	2 Pass	4
Prepare Packet	2	2	Ready for MEPS	4
Visit MEPS	2	6	1 NPS	12
TPU Visit	1	4	Visit	4
TOTAL				80.3

Time to Recruit NPS Essentially Constant Throughout USAREC

Rationale

We assert that the time to recruit an NPS is essentially the same throughout USAREC, provided that recruiters are allocated and missioned using *membership-adjusted vacancies*. Support is based on the following:

- Interviews with USAR recruiters with experience recruiting at other than their current location.
- The strong correlations of *membership-adjusted vacancies* with recruiting performance at RSIDs (using 1029 RSIDs).

As shown by our earlier report assessing the time required to recruit an NPS, the most critical variable in NPS recruiting time is the number of prospects that must be contacted in order to garner interview candidates. We show in Table XIV how our estimate of 50-60 contacts for one recruit is essentially similar to a USAREC[37] brief on USAR recruiting which states that 140 contacts had to be made.

Table XIV. ORRM Time-to-Recruit an NPS Compared to USAREC Command Brief's Times

THIS TIME STUDY			USAREC BRIEF	
Action	Number of Candidates	Outcome	Number of Candidates	USAREC Terminology
Prospecting	50-60	5 Interview Appointments	140	Contacts Made
"Conduct" Interview	5	3 for ASVAB	14	Appointments Conducted
Take ASVAB	3	2 pass	3.4	Tested
Prepare Packet	2	Prep. MEPS		
MEPS	2	1 NPS	1.7	Fully Qualified
TPU Visit	1	Visit	1.2	Contracted

There is a difference between the estimates of *contacts* made in Table XIV. Our contact estimates are lower because of a stricter definition of a *contact*. We required that a *contact* include at least a rejection, explicit or implicit, of a recruiter's attempt to continue the conversation about Army service.

The USAREC Command Brief reported that interview appointments are kept by only half of the contactees who make appointments. Our study counted only the interview appointments that *actually resulted* in an interview at the RS or elsewhere. We did not consider it necessary to garner information on the show rate of prospects at interviews.

[37] USAREC Command Briefing on Army Reserve Recruiting, *Recruiting for America's Army.*

There is a difference between the estimates of *contacts* made in Table XIV. Our contact estimates are lower because of a stricter definition of a *contact*. We required that a *contact* include at least a rejection, explicit or implicit, of a recruiter's attempt to continue the conversation about Army service.

The USAREC Command Brief reported that interview appointments are kept by only half of the contactees who make appointments. Our study counted only the interview appointments that *actually resulted* in an interview at the RS or elsewhere. We did not consider it necessary to garner information on the show rate of prospects at interviews.

We justified our estimate of only 50-60 contacts by recognizing that within the 50 hours each recruiters allocate to prospecting, there would be sufficient time to carry conversations to the point required in our definition. On the other hand, accomplishing about 140 *contacts,* using a more general definition of a contact, is also conceivable within 50 hours. This example shows a need for a precise definition of a contact. We suggest that the number of *conduct interviews* are better indicators of prospecting performance than contacts.

USAREC's and our estimates converged at the *conduct interview* point. From that point to accession, there is little practical difference. The USAREC Brief apparently estimated a 20% DTP loss rate. We did not incorporate this loss rate because we understood that USAREC considers the recruiting process completed when a candidate is brought to the TPU.

The above comparison with the USAREC brief suggests that the column of USAREC numbers represents a USAREC-wide average. This would confirm that our estimates, which were gathered from disparate sources, could also constitute an average. Our conclusion is that uniform recruiting times can hold, provided that recruiter tasking is consistent with *membership-adjusted vacancies*. This conclusion appears reasonable since recruiter consider that two factors are crucial for USAR recruiting: market propensity and vacancies. *Membership-adjusted vacancies* incorporate both factors.

Background Rational for Membership-Adjusted Vacancies

We were tasked by this DO to address recruiting at the RS level and were later asked by USAREC to address costs at the ZIP code level. USAREC wanted a methodology that could order ZIP codes by their recruiting costs. Our response in the Request For Delivery Order (proposal) stated that, with the resources available, we could only address costs at the battalion level. Our response was influenced by the knowledge that the USAREC RZA Study, which had substantially more resources, but could not develop a fully satisfactory model at the RS level. We were gratified that our *membership-adjusted vacancy* concept was capable of addressing recruiting resource costs al all levels: from ZIP codes and up.

This DO also required considering recruiting propensity. In response, our use of *membership-adjusted vacancies* correlates at 90% with enlistments at a ZIP code; a clear indication of propensity.

Performance Data Correlations

The sections that follow describe how we can use available data to forecast recruiting performance. We then show that our predictor has better correlations[39] with recruiting performance than traditional measures such as MA and demographic densities.

Membership-adjusted Vacancies Correlate Strongly with Production

Our data analyses determined that E1-3 membership in a ZIP code correlated at the .82 level with NPS production while NPS losses from ZIP codes correlated only at the .60 level. (Losses are very similar to vacancies.) Our predictor variable, *N*, is formed by prorating the vacancies at an RS by the proportion of members in a ZIP code. We call this predictor variable *membership-adjusted vacancies*, it correlates with NPS production at the .91 level.

Traditional Propensity Measures Correlate Poorly with Production

Referencing the Statement of Task (SOT), we saw no value in pursuing such variables as population density and mix, etc. The various population and other densities listed in the SOT correlate with enlistments at .25 or less. Since *membership-adjusted vacancies* correlated so highly, it was not necessary to pursue other avenues.

Table XV gives relevant correlations. It shows clearly that *membership-adjusted members* is a superior production measure compared to traditional measures.

Task 4. Cost Model Brief at USAREC

This briefing was conducted by Dr. McWhite at USAREC on 19 January 1996.

Task 5. Develop ORRM Formulation

This task directed development of an ORRM that maximizes recruiting efficiency, i.e. maximizes production, of the USAR recruiter force. Correspondingly the ORRM must determine the minimum number of recruiters needed to achieve a stated production level. This would allow USAREC RO to determine the potential impact of changes in the USAR recruiting force.

The ORRM must also determine the resources necessary for recruiting NPS and PS soldiers at command levels from brigade to RS. Using this information, the ORRM would allocate effort among NPS and PS recruiting.

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[39] We determined the following correlations using all 1029 RSIDs.

Table XV. Traditional Propensity Measures Correlate Poorly with Production Compared to Membership-Adjusted Vacancies

Independent Variable	Correlation with NPS Production from a Given ZIP code in FY '95
E1-3 ZIP Membership	.82
'95 NPS Losses in ZIP	.60
"N" or *Adjusted Vacancies*	.91
Primary 17-21 Male Current Population in ZIP Prorated to Remove Effects of ARNG	.24
Woods & Poole ZIP Military Available Male 17-21	.25
Density of 17-21 Male Population in ZIP	.18
Density of Military Available 17-21 Male	.18
NPS Losses per ZIP Population	.42

During the proposal stages of the study we had determined that contract resources (and available data) were not sufficient to work at the RS level. Therefore we had expected to limit ourselves the Rctg Bn level. However we later determined that using *membership-adjusted vacancies* permits us to model at the ZIP code level. We developed the following ORRM allocation formulation to exploit the predictive power of membership-adjusted vacancies.

ORRM Overview

Using the ORRM, recruiter allocation to ZIP codes is accomplished by:

A. Membership-Adjusted Vacancies x Hours to Recruit = Effort at ZIP

B. Optimization is completed when available recruiter effort is allocated.

C. Allocation to ZIPs can be rolled up to provide optimal allocation to RS, company and Bn.

D. Recruiters for NPS and PS are allocated separately.
   1. Civil Life gains are allocated historically.

ORRM Formulation

Table XVI defines the terminology used in (1) the ORRM Linear Program, which follows.

Table XVI. ORRM Constants and Variables

Name	Expanded Name	Explanation
Sets		
i	ZIPcodes in USAREC, a bde, bn, company or station.	ZIPcodes assigned to an RS supporting a USAR TPU
Parameters		
N_i P_i	NPS PS projected recruits	Annual NPS or PS production by a unit recruiter in $ZIPcode_i$.
Scalars		
$NVac_i$ $PVac_i$	NPS PS vacancies	NPS, PS, vacancies at $ZIPcode_i$ as a proportion of the parent RS' vacancies. Proportion is based on $ZIPcode_i$'s members compared to all members in parent RD.
NRec PRec Rec	NPS recruiters PS recruiters Total recruiters	NPS recruiters + PS recruiters = Available recruiters
Variables		
NR_i PR_i	NPS Recruiters (i) PS Recruiters (i)	Number of NPS or PS recruiters at ZIPcode (i)

Model Description

The ORRM described above will solve for the optimal allocation (maximum production, minimum recruiters) of USAR recruiters to ZIP codes, RS, Company and Bn. It is formulated as a linear programming (LP) Knapsack problem but no special optimization procedures are needed because of its special structure. As will be discussed below, the optimal solution is found by sorting the data on the independent variable, N.

In practice the operator should separately solve the NPS and PS problems. This will require determining the number of recruiters, or the fraction of total recruiters that are to be made available for NPS and PS recruiting. Guidance for the decision is found below. Solving separately the NPS and PS problems is not a restriction. Any methodology would require that the user decide for either maximum production or minimum recruiters and within that determination, decide whether to emphasize NPS or PS. In the example which follows, we will solve for optimum NPS production or recruiter allocation; the user will solve for PS production in like manner.

$$\textbf{Max: } \Sigma_i N_i NR_i + \Sigma_i P_i PR_i$$

$$\textbf{s.t.:}$$

$$N_i NR_i \leq NVac_i \ \forall \ i$$
$$P_i PR_i \leq PVac_i \ \forall \ i$$

$$\Sigma_i NR_i \leq NRec$$
$$\Sigma_i PR_i \leq PRec$$

$$NRec + PRec = Rec$$

$$NR_i, PR_i \geq 0$$

$$i \in ZIPs$$

(1) ORRM Linear Program

ORRM Database Setup

The data base setup requires for each RSID-ZIP the:

- Number of E1-3 TPU members
- Number of NPS vacancies allocated to the parent RS.

ORRM Manual Solution Procedure

Using these data the user must determine the proportion of members for each ZIP code in each RS. Then allocate the RS' vacancies by each ZIP code's corresponding proportion members within that RS' ZIP codes. For example, RS lHlJ might be missioned to fill 20 vacancies and contain 100 members within the boundaries of its ZIP codes, of which ZIP 90302 with 20 members would have a members proportion of 20% while the 10 in ZIP 90405 give a members proportion of 10%. Weighting the RS' total vacancies by each ZIP code's members proportion gives the ZIP-level membership-adjusted vacancies. These data are summarized in Table XVII below.

N's are computed in like manner for all RSID/ZIPs. The next step is to sort all N's in decreasing order. Then each *N* (membership-adjusted vacancies) is divided by a unit recruiter's annual production. The quotient gives the fractional number of recruiters to be assigned to each ZIP code. The same process holds for the higher recruiting command levels.

Table XVII. Simplified ORRM Example

RSID/ZIP *	Members in ZIP	Percent Members	Vacancies at RS 1L1J	Member-adjusted Vacancies (*N*)
1L1J 90302	20	20		6
1L1J 90405	10	10		3
...	...	...		...
TOTAL in RS 1L1J:	100	100	30	30

* Data are hypothetical.

Optimal Mix of NPS and PS Recruiting Efforts

The Knapsack problem structure leads to a straightforward algorithm:

- Assuming that NPS and PS recruits are valued identically, one simply intermixes *N*'s and *P*'s and missions recruiters accordingly.
- As with the original ORRM, continue this procedure until either the desired production is achieved or available recruiters are assigned.
- This procedure will maximize total recruiting production (or minimize recruiters needed). It is self-correcting as recruiter effort would only be assigned to the limit of NPS or (probably) PS vacancies at a ZIP code.
- Should NPS or PS need greater emphasis, then one should weight the appropriate *N*'s or *P*'s *for the purpose of ordering these terms only.* Then use the unweighted *N*'s or *P*'s for determining recruiter allocation or missioning.

ORRM Solution Examples

Table XVIII uses data on the Nashville Bn, 3I. Its ZIP codes have been ordered by their respective *Ns*. After the *Ns* column the *Ns* are divided by the unit recruiter's annual production to obtain the column called */ZIP* to compute the optimal recruiters per ZIP code. This production is accumulated (for the entire battalion) in the *CUMM* column. The next column accumulates the *Ns* to give net production for each successive ZIP code. The column on the right shows the poor relationship to production of traditional measures such as population, MA, and density.

With Table XVIII the Nashville Bn can observe the impact of different recruiter allocations on their potential production. This information will be especially useful for suggesting (or defending) recruiter reductions.

It is important to recognize the following:

- Table XVIII was ordered for NPS recruiting. It is easy to reorder it for optimal recruiter assignments for either PS or combined NPS and PS production.
- NPS vacancies are only based on FY 95 losses. Delta (DELT), TPU under/over strength is not considered. The *Delta* column could be incorporated to provide a more relevant mission.
- Table XVIII contains only a partial list of ZIP codes. We removed all ZIP codes with *N* values less than .1 since they would have low production potential.

Table XVIII. Annotated ORRM Calculations for Nashville Bn

The next 3 pages contain annotated spreadsheets which demonstrate ORRM methodology. Solve with the following methodology:

> From the top line down, find the row with the CUMMUL RCTR that corresponds to the set number of recruiters available. The selected row's CUMMUL NPS value gives the number of NPS recruits expected.
>
> Correspondingly, find the row with the annual recruit production or CUMMUL NPS required. The selected row's CUMMUL RCTR gives the number of recruiters necessary to access the target number.

Each row on or above the selected row represents the optimal ZIP code for recruiter assignments to attain the desired maximum production (from recruiters) or minimal recruiters for a set goal.

Nashville Bn Tutorial

3I NPS Recruits per year per recruiter: 19 PS Transitions per year per recruiter: 50

Bn Ordered by N, the NPS adjusted vacancies, Has N+, P+

BN	CO	RSID/ZIP	MEMBRS 1–3	MEMBRS 4–9	LOSS 1–3	LOSS 4–9	ENLIST 1–3	ENLIST 4–9	N	N+	RCTR /ZIP	RCTR CUMMUL	NPS MUL	P	P+	RCTR /ZIP	RCTR CUMMUL	PS MUL	UND	N+P+	RCTR /ZIP	RCTR CUMMUL	N+P+ MUL
		TOTALS:	454	1,232	114	440	182	408	157	372	20	**	**	420	636	13	**	**	431	1008	33	**	**
3I	3I8	3I8B40601	18	47	8	18	10	10	7.9	14.4	0.8	0.8	14.4	12.2	18.7	0.4	0.4	19	13	33	1	1	33
3I	3I7	3I7H42701	15	66	6	14	9	32	6.4	13	0.7	1.5	27.3	21.2	27.8	0.6	0.9	46	13	41	1	2	74
3I	3I8	3I8J40475	15	38	5	12	10	6	5.9	13	0.7	2.2	40.7	10.9	18.4	0.4	1.3	65	15	32	1	3	106
3I	3I1	3I1H37013	13	20	2	11	4	7	5.4	9.2	0.5	2.7	50.0	6.8	10.7	0.2	1.5	76	8	20	1	4	126
3I	3I2	3I2N37343	16	27	5	7	4	5												34	1	5	159
3I	3I8	3I8W40391	11	33	3	10	6	6												16	0.5	5.9	175
3I	3I7	3I7B42101	13	29	1	18	7	4												21	0.7	6.6	197
3I	3I5	3I5C42240	14	37	2	10	4	25												37	1.0	7.6	234
3I	3I8	3I8W4038C	7	4	2	0	2	2												5	0.2	7.8	239
3I	3I8	3I8W40351	7	17	1	4	4	4												9	0.3	8.1	248
3I	3I1	3I1H37211	7	32	3	10	2	9												24	0.7	8.9	272
3I	3I2	3I2N37341	9	3	2	1	1	2												12	0.5	9.4	284
3I	3I8	3I8J40504	7	29	1	7	0	5												21	0.7	10.0	305
3I	3I8	3I8J40356	7	18	2	3	2	5												16	0.6	10.6	321
3I	3I1	3I1P37216	7	11	0	2	2	4												11	0.4	11.0	332
3I	3I7	3I7H42718	6	13	3	6	0	6												10	0.3	11.3	342
3I	3I8	3I8W40361	6	14	2	10	4	2												8	0.3	11.6	349
3I	3I1	3I1D37130	8	15	1	8	4	11												19	0.6	12.2	368
3I	3I1	3I1V37209	8	21	3	9	0	10												18	0.6	12.8	387
3I	3I5	3I5C42223	9	18	0	12	2	38												22	0.6	13.4	409
3I	3I5	3I5C37040	9	33	4	13	5	30												34	0.9	14.3	443
3I	3I5	3I5C42262	9	16	0	8	3	25												19	0.5	14.8	461
3I	3I1	3I1P37207	6	34	0	7	5	5	2.2	6.3	0.3	9.2	170.5	10.0	14.1	0.3	6.2	311	8	20	0.6	15.4	482
3I	3I2	3I2N37421	7	22	4	6	3	6	2.2	9.9	0.5	9.7	180.3	6.4	14.0	0.3	6.5	325	15	24	0.8	16.3	506
3I	3I2	3I2N37415	7	9	4	9	1	2	2.2	5.4	0.3	10.0	185.7	2.6	5.8	0.1	6.6	331	6	11	0.4	16.7	517
3I	3I8	3I8B40383	5	11	1	4	0	2	2.2	3.8	0.2	10.2	189.5	2.9	4.4	0.1	6.7	336	3	8	0.3	17.0	525
3I	3I1	3I1H37217	5	22	3	7	2	6	2.1	5	0.3	10.5	194.4	7.5	10.4	0.2	6.9	346	6	15	0.5	17.4	540
3I	3I1	3I1H37167	5	7	2	3	5	6	2.1	4	0.2	10.7	198.5	2.4	4.3	0.1	7.0	350	4	8	0.3	17.7	549
3I	3I1	3I1H37214	5	14	1	3	6	6	2.1	3.5	0.2	10.9	202.0	4.8	6.2	0.1	7.1	356	3	10	0.3	18.0	558
3I	3I1	3I1V37221	7	3	1	1	0	3	2	4.1	0.2	11.1	206.1	1.2	3.3	0.1	7.2	360	4	7	0.3	18.3	566

The column to the left, *N*, is **Adjusted Vacancies.** It is computed by multiplying the number of vacancies apportioned to an RS by the proportion of *Members* (E1–3 for NPS) in a given ZIP code. *N* combines *members* (propensity) with a key sales tool: numbers of vacancies. It also represents that ZIP's share of vacancies and the number of NPS that could be recruited that year.

The next column, N^+, is computed by *N + (.5UND).* Like *N, UND*er Strength is computed by adjusting the difference between on board and authorized strength by an RS' proportion of members in a given ZIP.

On this sheet we have sorted all the ZIPs in the Nashville Bn by *N.* At the top one sees the ZIPs with the highest NPS recruiting potential.

Nashville Bn Tutorial

3I NPS Recruits per year per recruiter: 19 PS Transitions per year per recruiter: 50

Bn Ordered by N, the NPS adjusted vacancies, Has N+, P+

BN	CO	RSID/ZIP	MEMBRS 1–3	MEMBRS 4–9	LOSS 1–3	LOSS 4–9	ENLIST 1–3	ENLIST 4–9	N	N+	RCTR /ZIP	RCTR CUMMUL	NPS **	P	P+	RCTR /ZIP	RCTR CUMMUL	PS **	UND	N+P+	RCTR /ZIP	RCTR CUMMUL	N+P+ **
		TOTALS:	454	1,232	114	440	182	408	157	372	20	**	**	420	636	13	**	**	431	1008	33	**	**
3I	3I8	3I8B40601	18	47	8	18	10	10	7.9	14.4	0.8	0.8	14.4	12.2	18.7	0.4	0.4	19	13	33	1	1	33
3I	3I7	3I7H42701	15	66	6	14	9	32	6.4	13	0.7	1.5	27.3	21.2	27.8	0.6	0.9	46	13	41	1	2	74
3I	3I8	3I8J40475	15	38	5	12	10	6	5.9	13	0.7	2.2	40.7	10.9	18.4	0.4	1.3	65	15	32	1	3	106
3I	3I1	3I1H37013	13	20	2	11	4	7	5.4	9.2	0.5	2.7	50.0	6.8	10.7	0.2	1.5	76	8	20	1	4	126
3I	3I2	3I2N37343	16	27	5	7	4	5												34	1	5	159
3I	3I8	3I8W40391	11	33	3	10	6	6												16	0.5	5.9	175
3I	3I7	3I7B42101	13	29	1	18	7	4												21	0.7	6.6	197
3I	3I5	3I5C42240	14	37	2	10	4	25												37	1.0	7.6	234
3I	3I8	3I8W4038(	7	4	2	0	2	2												5	0.2	7.8	239
3I	3I8	3I8W40351	7	17	1	4	4	4												9	0.3	8.1	248
3I	3I1	3I1H37211	7	32	3	10	2	9												24	0.7	8.9	272
3I	3I2	3I2N37341	9	3	2	1	1	2												12	0.5	9.4	284
3I	3I8	3I8J40504	7	29	1	7	0	5												21	0.7	10.0	305
3I	3I8	3I8J40356	7	18	2	3	2	5												16	0.6	10.6	321
3I	3I1	3I1P37216	7	11	0	2	2	4												11	0.4	11.0	332
3I	3I7	3I7H42718	6	13	3	6	0	6												10	0.3	11.3	342
3I	3I8	3I8W40361	6	14	2	10	4	2												8	0.3	11.6	349
3I	3I1	3I1D37130	8	15	1	8	4	11												19	0.6	12.2	368
3I	3I1	3I1V37209	8	21	3	9	0	10												18	0.6	12.8	387
3I	3I5	3I5C42223	9	18	0	12	2	38												22	0.6	13.4	409
3I	3I5	3I5C37040	9	33	4	13	5	30												34	0.9	14.3	443
3I	3I5	3I5C42262	9	16	0	8	3	25												19	0.5	14.8	461
3I	3I1	3I1P37207	6	34	0	7	5	5												20	0.6	15.4	482
3I	3I2	3I2N37421	7	22	4	6	3	6												24	0.8	16.3	506
3I	3I2	3I2N37415	7	9	4	9	1	2												11	0.4	16.7	517
3I	3I8	3I8B40383	5	11	1	4	0	2												8	0.3	17.0	525
3I	3I1	3I1H37217	5	22	3	7	2	6												15	0.5	17.4	540
3I	3I1	3I1H37167	5	7	2	3	5	6												8	0.3	17.7	549
3I	3I1	3I1H37214	5	14	1	3	6	6												10	0.3	18.0	558
3I	3I1	3I1V37221	7	3	1	1	0	3												7	0.3	18.3	566
3I	3I8	3I8J40505	5	36	3	15	2	9	2	6.2	0.3	11.5	212.3	10.3	14.6	0.3	7.5	374	9	21	0.6	19.0	587
3I	3I2	3I2L37311	6	13	3	5	3	3	2	9	0.5	12.0	221.3	5.6	12.7	0.3	7.7	387	14	22	0.7	19.7	608

The */ZIP* column gives the recruiter–years needed to recruit all the *Adjusted Vacancies* in each ZIP. It is the N^+ divided by the number of NPS recruits that a recruiter can access in a year. For this example we estimated 18.5 recruits/recruiter–year.

The column to the right, *RCTR CUMM*(ulative), is a continuous summation of the */ZIP* values from the top down. This is done for each entity (Bn, RS, etc.) described by a spreadsheet. The next column, *NPS CUMM*, gives the cummulative production possible (by summing the corresponding N^+ values).

One solves this ORRM for the optimum (maximal) production, given a set number of recruiters, by reading the RCT CUMM production column value corresponding to the number of recruiters. Because we have exploited the special structure of a linear optimization problem with a single constraint, the above procedure provides a continuous set of optimal solutions to the maximum production possible from a set number of recruiters; or conversly, the minimal number of recruiters needed to provide a given NPS production.

Nashville Bn Tutorial

3I NPS Recruits per year per recruiter: 19 PS Transitions per year per recruiter: 50

Bn Ordered by N, the NPS adjusted vacancies, Has N+, P+

BN	CO	RSID/ZIP	MEMBRS 1–3	MEMBRS 4–9	LOSS 1–3	LOSS 4–9	ENLIST 1–3	ENLIST 4–9	N	N+	RCTR /ZIP	RCTR CUMMUL	NPS CUMMUL	P	P+	RCTR /ZIP	RCTR CUMMUL	PS CUMMUL	UND	N+P+	RCTR /ZIP	RCTR CUMMUL	N+P+ CUMMUL
		TOTALS:	454	1,232	114	440	182	408	157	372	20	**	**	420	636	13	**	**	431	1008	33	**	**
3I	3I8	3I8B40601	18	47	8	18	10	10	7.9	14.4	0.8	0.8	14.4	12.2	18.7	0.4	0.4	19	13	33	1	1	33
3I	3I7	3I7H42701	15	66	6	14	9	32	6.4	13	0.7	1.5	27.3	21.2	27.8	0.6	0.9	46	13	41	1	2	74
3I	3I8	3I8J40475	15	38	5	12	10	6	5.9	13	0.7	2.2	40.7	10.9	18.4	0.4	1.3	65	15	32	1	3	106
3I	3I1	3I1H37013	13	20	2	11	4	7	5.4	9.2	0.5	2.7	50.0	6.8	10.7	0.2	1.5	76	8	20	1	4	126
3I	3I2	3I2N37343	16	27	5	7	4	5													1	5	159
3I	3I8	3I8W40391	11	33	3	10	6	6													0.5	5.9	175
3I	3I7	3I7B42101	13	29	1	18	7	4													0.7	6.6	197
3I	3I5	3I5C42240	14	37	2	10	4	25													1.0	7.6	234
3I	3I8	3I8W4038(	7	4	2	0	2	2													0.2	7.8	239
3I	3I8	3I8W40351	7	17	1	4	4	4													0.3	8.1	248
3I	3I1	3I1H37211	7	32	3	10	2	9													0.7	8.9	272
3I	3I2	3I2N37341	9	3	2	1	1	2													0.5	9.4	284
3I	3I8	3I8J40504	7	29	1	7	0	5													0.7	10.0	305
3I	3I8	3I8J40356	7	18	2	3	2	5													0.6	10.6	321
3I	3I1	3I1P37216	7	11	0	2	2	4													0.4	11.0	332
3I	3I7	3I7H42718	6	13	3	6	0	6													0.3	11.3	342
3I	3I8	3I8W40361	6	14	2	10	4	2													0.3	11.6	349
3I	3I1	3I1D37130	8	15	1	8	4	11													0.6	12.2	368
3I	3I1	3I1V37209	8	21	3	9	0	10													0.6	12.8	387
3I	3I5	3I5C42223	9	18	0	12	2	38													0.6	13.4	409
3I	3I5	3I5C37040	9	33	4	13	5	30													0.9	14.3	443
3I	3I5	3I5C42262	9	16	0	8	3	25													0.5	14.8	461
3I	3I1	3I1P37207	6	34	0	7	5	5													0.6	15.4	482
3I	3I2	3I2N37421	7	22	4	6	3	6													0.8	16.3	506
3I	3I2	3I2N37415	7	9	4	9	1	2	2.2	5.4	0.3	10.0	185.7	2.6	5.8	0.1	6.6	331	6	11	0.4	16.7	517
3I	3I8	3I8B40383	5	11	1	4	0	2	2.2	3.8	0.2	10.2	189.5	2.9	4.4	0.1	6.7	336	3	8	0.3	17.0	525
3I	3I1	3I1H37217	5	22	3	7	2	6	2.1	5	0.3	10.5	194.4	7.5	10.4	0.2	6.9	346	6	15	0.5	17.4	540
3I	3I1	3I1H37167	5	7	2	3	5	6	2.1	4	0.2	10.7	198.5	2.4	4.3	0.1	7.0	350	4	8	0.3	17.7	549
3I	3I1	3I1H37214	5	14	1	3	6	6	2.1	3.5	0.2	10.9	202.0	4.8	6.2	0.1	7.1	356	3	10	0.3	18.0	558
3I	3I1	3I1V37221	7	3	1	1	0	3	2	4.1	0.2	11.1	206.1	1.2	3.3	0.1	7.2	360	4	7	0.3	18.3	566

E1–3 vacances correlate best with NPS production, leaving E4+ members to adjust vacancies for PS fill.

CUMM PS are calculated the same way as their NPS counterpart. The *P* and *P+* are similarly computed with $P^+ = P + (.5UND)$. The column $N^+ + P^+$ is $(N + P + UND)$ or $([N^+]+[P^+])$. It represents *Adjusted Vacancies* that could be assigned a recruiting effort sufficient to fully man understrength TPUs (or decrease in effort if overstrength).

Overstrength TPUs have negative *UND*, so N^+ or P^+ will suggest a lesser recruiting effort. If fully manning understrength TPUs within a year is not intended, including *UND* would show increased propensity at a ZIP because of an apparent variety of vacancies.

The proportions of NPS and PS in *UND* (*Adjusted Vacancies)* are based on TPU structure.

Task 6. Computer-based Optimization Incorporating the ORRM

The ORRM Linear Optimization

The ORRM is a linear optimization with a single constraint. Its special structure yields a Knapsack[40] Problem which is solved by successively placing the remaining items (ZIP codes) with the greatest unit value $(N+P)$ in the optimal solution. One then assigns the appropriate number of resources (recruiters). If maximization of recruit production is desired, the process terminates when all available recruiters are used. If minimizing recruiters subject to a given production is desired, the process is stopped when the unit values (summation of assigned $(N+P)$ reach the required level. The resulting assigned resources (recruiters) will be a the minimum value.

The Knapsack structure allows one to produce a set of optimal solutions by ordering ZIP codes by decreasing $N+P$ values.[41] A spreadsheet can compute the associated unit recruiters assigned to each ZIP code, the cumulative recruiters, and cumulative production. An optimal solution is easily obtained by going down the spreadsheet until available recruiters are depleted (maximize production) or until required production is attained (minimize recruiters). This procedure works at the RS, company, battalion, brigade or USAREC level. The three spreadsheets labeled *Nashville Battalion* demonstrated this procedure.

[40] In this problem type one attempts maximize the value of items sequentially loaded into a limited space. Items are optimally loaded in decreasing order of their costs divided by their coefficient on the single constraint.

[41] Note that N and P are the ratios of member-*adjusted vacancies* divided by unity, which is the coefficient of each variable representing the number of recruiters.

Task 7. Demonstrate ORRM at USAREC.

This demonstration was conducted 1 April 1996.

The next set of spreadsheets, labeled *ORRM Demonstration,* shows that the ORRM methodology has promise for increasing the overall efficiency of the recruiting process. The first of these sheets (is the first page of) the entire USAREC. The next sheet is for Company 6D2 in the Denver Bn. On each page, one can note that the $N+P$ column totals are consistent with the missions for each of these commands. These sheets demonstrate that the ORRM:

- Provides a rapid solution.
- Is highly portable.
- Is easy to understand.
- Is transparent. All levels can understand the basis for their mission and have a reasonable basis for agreeing or disagreeing, resulting in improved performance and morale.
- Follows accepted industrial engineering principles by breaking down the NPS and PS production tasks (because each requires substantially different effort).

Table XIX. All-USAREC ORRM (first page)

All USAREC, sort by N.

3I NPS Recruits per year per recruiter. 18.5 PS Transitions per year per recruiter: 50

All USAREC Ordered by N, the NPS adjusted vacancies; with computations for N+, [N+(.5) over/under strength (UND)], P+ and N+ (+) P+.

BN	CO	RSID/ZIP	MEMBRS 1-3	MEMBRS 4-9	LOSS 1-3	LOSS 4-9	ENLIST 1-3	ENLIST 4-9	Ajusted Vacancies N	Ajusted Vacancies N+	RCTR /ZIP	RCTR CUMMUL	NPS Ajusted Vacancies P	NPS Ajusted Vacancies P+	RCTR /ZIP	RCTR CUMMUL	PS Ajusted Vacancies UNDN+P+	RCTFN+P+ /ZIP	RCTFN+P+ CUMMUL	MIL A 17M	MIL A 22M	POPULATION 17-21	POPULATION 22-29	POPULATION AREA	DENS_PO DENS N	DENS_PO DENS P	M,POPULA N	M,POPULA P
		TOTALS:	39,092	66,162	9,301	24,984	12,723	21,684	11,682	17,225	931	**	** 23,069	28,612	572	**	** 11,086	45,837	899	**	**	16971	15170	69579	63100	6549				
6H	6H5	6H5W96797	48	111	11	17	22	31	16.5	46.4	2.5	2.5	46	33.5	63.4	1.3	1.3	63	59.8	110	3.8	3.8	109.7	119	92	406	316	30	14	11	4	3	7	3
1K	1K3	1K3W19143	52	84	20	40	13	19	16.0	29.6	1.6	4.1	76	25.6	39.3	0.8	2.1	103	27.4	69	2.4	6.2	178.7	746	1127	1747	2641	3	527	796	225	340	16	5
4J	4J5	4J5G71901	26	19	16	6	17	3	15.1	18.0	1.0	5.1	94	5.9	8.8	0.2	2.2	111	5.8	27	1.1	7.3	205.5	434	370	1438	1222	127	11	10	3	3	24	21
4G	4G6	4G6M66502	71	112	5	33	19	55	14.9	26.9	1.5	6.5	121	46.1	58.1	1.2	3.4	170	24.1	85	2.6	9.9	290.5	1232	999	4359	3533	222	20	16	6	5	10	6
1K	1K4	1K4C08046	38	43	18	16	11	10	14.8	27.1	1.5	8.0	148	12.8	25.2	0.5	3.9	195	24.7	52	2.0	11.9	342.8	444	568	1200	1535	8	148	189	55	70	9	3
3D	3D1	3D1A30906	52	111	8	36	17	62	14.2	4.0	0.2	8.2	152	46.7	36.5	0.7	4.6	231	-20.4	41	0.9	12.8	383.4	571	558	2285	2233	89	26	25	6	6	34	18
5J	5J6	5J6M53218	40	75	15	33	8	14	13.3	19.5	1.1	9.3	171	23.2	29.3	0.6	5.2	261	12.3	49	1.6	14.5	432.1	597	658	1483	1636	6	249	275	100	111	13	9
5A	5A3	5A3J60628	38	91	19	37	9	34	12.9	15.5	0.8	10.1	187	32.3	34.9	0.7	5.9	295	5.2	50	1.5	16.0	482.5	910	1091	2237	2684	11	196	235	80	96	16	5
4J	4J7	4J7G71602	32	13	3	3	27	17	12.9	19.9	1.1	11.2	207	6.0	13.1	0.3	6.2	309	14.2	33	1.3	17.4	515.5	118	80	557	378	69	8	5	2	1	7	3
4J	4J7	4J7P72076	41	39	8	17	15	17	12.8	16.4	0.9	12.1	223	16.0	19.6	0.4	6.6	328	7.3	36	1.3	18.6	551.6	89	103	555	638	64	9	10	1	2	7	4
6J	6J2	6J2B84120	37	53	11	11	11	19	12.4	11.8	0.6	12.7	235	15.5	15.0	0.3	6.9	343	1.1	27	0.9	19.6	578.3	418	367	1494	1307	17	87	76	24	21	6	2
1B	1B7	1B7W22193	42	80	7	24	18	32	12.3	8.5	0.5	13.2	244	34.1	30.3	0.6	7.5	373	-7.6	39	1.1	20.6	617.2	514	679	1624	2143	16	105	138	33	44	15	9
6I	6I8	6I8D94509	38	30	8	7	15	9	12.3	15.3	0.8	14.0	259	8.7	11.7	0.2	7.7	385	6.1	27	1.1	21.7	644.2	483	434	1377	1239	29	47	43	17	15	6	3
6H	6H5	6H5W96786	35	68	14	25	11	53	12.0	34.2	1.8	15.8	293	20.5	42.7	0.9	8.6	428	44.3	77	2.7	24.4	721.0	260	244	823	775	39	21	20	7	6	15	7
5J	5J1	5J1R54901	29	54	7	10	17	10	12.0	7.0	0.4	16.2	300	10.0	5.0	0.1	8.7	433	-10.0	12	0.5	24.9	733.0	1209	1160	2819	2706	52	54	52	23	22	15	16
1K	1K5	1K5N19720	34	35	14	14	10	10	11.8	18.8	1.0	17.2	319	13.3	20.2	0.4	9.1	453	13.9	39	1.4	26.3	772.0	686	733	1796	1921	33	55	58	21	22	17	5
1L	1L4	1L4F16101	27	25	10	9	11	8	11.7	12.0	0.6	17.9	331	8.4	8.7	0.2	9.2	462	0.6	21	0.8	27.1	792.7	588	437	1238	922	61	20	15	10	7	12	4
1B	1B8	1B8J23602	36	135	12	43	11	42	11.7	0.8	0.0	17.9	332	50.5	39.6	0.8	10.0	501	-21.7	40	0.8	28.0	833.2	862	994	1821	2098	24	75	87	36	41	16	10
1G	1G1	1G1P11203	54	64	10	20	8	14	11.6	8.0	0.4	18.4	340	16.2	12.6	0.3	10.3	514	-7.2	21	0.7	28.6	853.8	742	1102	2019	2986	2	963	1425	354	526	10	4
3D	3D2	3D2S29115	34	56	5	18	15	11	11.6	14.8	0.8	19.2	355	15.2	18.4	0.4	10.6	532	6.4	33	1.2	29.8	887.0	373	399	1333	1423	211	6	7	2	2	17	6
1K	1K3	1K3E19120	37	52	14	14	10	21	11.5	33.2	1.8	21.0	388	16.7	38.5	0.8	11.4	571	43.5	72	2.6	32.4	958.7	815	854	1924	2013	3	632	661	268	281	17	6
5H	5H6	5H6R40121	61	26	7	15	7	56	11.4	15.2	0.8	21.8	403	13.1	17.0	0.3	11.8	588	7.7	32	1.2	33.5	990.9	252	123	647	316	125	5	3	2	1	12	5
3A	3A2	3A2A30349	30	106	7	36	7	34	11.1	8.3	0.5	22.2	411	30.2	27.4	0.5	12.3	615	-5.5	36	1.0	34.5	1026.6	440	664	1299	1961	51	26	39	9	13	12	5
4G	4G4	4G4L66048	33	48	9	19	10	33	10.9	15.2	0.8	23.1	427	27.6	31.9	0.6	12.9	647	8.6	47	1.5	36.0	1073.7	192	209	512	559	112	5	5	2	2	4	2
1L	1L6	1L6S26505	61	74	8	28	10	22	10.9	16.6	0.9	24.0	443	25.0	30.7	0.6	13.6	678	11.4	47	1.5	37.5	1120.9	2530	1772	6008	4207	246	24	17	10	7	75	14
1B	1B1	1B1D21061	29	75	12	22	12	16	10.9	10.3	0.6	24.5	453	25.2	24.6	0.5	14.0	702	-1.2	35	1.0	38.6	1155.8	1019	1020	2851	2855	13	215	215	77	77	34	13
1B	1B5	1B5G21740	25	23	11	11	10	18	10.8	20.8	1.1	25.6	474	10.3	20.3	0.4	14.5	723	20.1	41	1.5	40.1	1196.9	575	781	1857	2515	83	22	30	7	9	25	7
3D	3D1	3D1A30815	38	87	3	21	15	51	10.4	3.1	0.2	25.8	477	36.6	29.3	0.6	15.0	752	-14.6	32	0.8	40.8	1229.3	167	169	615	623	162	4	4	1	1	10	5
5A	5A2	5A2V60426	35	62	18	31	7	29	10.3	11.9	0.6	26.4	489	23.8	25.4	0.5	15.5	777	3.2	37	1.2	42.0	1266.6	689	990	1470	2107	14	109	156	51	73	12	4
1E	1E9	1E9C18042	24	17	8	13	11	7	10.3	22.3	1.2	27.7	512	5.2	17.3	0.3	15.9	795	24.1	40	1.6	43.5	1306.3	876	709	2502	2030	62	40	33	14	11	17	6
1B	1B3	1B3P21229	29	62	7	15	12	19	10.3	10.3	0.6	28.2	522	17.7	17.6	0.4	16.2	812	-0.1	28	0.9	44.5	1334.2	456	746	1351	2202	6	226	369	76	125	15	6
4K	4K5	4K5D78228	38	62	7	15	14	30	10.3	9.4	0.5	28.7	531	19.3	18.4	0.4	16.6	831	-1.8	28	0.9	45.3	1361.9	509	529	1073	1112	11	96	99	45	47	24	10
3D	3D2	3D2K29203	35	84	8	17	10	25	10.2	7.6	0.4	29.1	539	25.0	22.5	0.4	17.1	853	-5.1	30	0.9	46.2	1392.0	264	259	1229	1209	75	16	16	4	3	10	6
4N	4N6	4N6S63376	38	36	3	10	16	10	10.1	20.4	1.1	30.2	559	12.9	23.1	0.5	17.5	876	20.6	44	1.6	47.8	1435.5	484	592	950	1161	27	36	44	18	22	8	3
1G	1G1	1G1P11212	47	65	9	18	13	17	10.1	6.6	0.4	30.6	566	16.4	12.9	0.3	17.8	889	-7.0	19	0.6	48.4	1455.0	489	700	1342	1921	1	930	1331	339	485	7	2
1G	1G1	1G1N11226	47	65	11	14	9	8	10.1	2.6	0.1	30.7	568	12.5	5.0	0.1	17.9	894	-14.9	8	0.2	48.6	1462.7	857	1286	2322	3480	1	1773	2656	654	982	11	4
1B	1B3	1B3J21213	27	38	11	12	5	16	10.0	10.5	0.6	31.3	579	15.2	15.7	0.3	18.2	910	0.9	26	0.9	49.5	1488.8	314	537	989	1682	3	290	492	92	157	10	4
1G	1G1	1G1D11213	47	49	4	8	10	5	10.0	7.2	0.4	31.7	586	7.6	4.8	0.1	18.3	915	-5.7	12	0.5	50.0	1500.8	453	675	1218	1815	1	1188	1771	442	659	6	2
1B	1B6	1B6F20019	25	30	15	10	14	7	10.0	8.0	0.4	32.1	594	11.4	9.5	0.2	18.5	924	-3.9	17	0.6	50.6	1518.3	324	484	908	1358	6	152	227	54	81	10	4
4N	4N6	4N6C65473	72	16	4	7	3	18	9.9	31.8	1.7	33.8	626	7.2	29.2	0.6	19.1	953	43.8	61	2.3	52.9	1579.3	270	33	512	64	97	5	1	3	0	9	4
3A	3A2	3A2D30331	36	47	5	26	13	14	9.9	8.1	0.4	34.3	634	17.8	15.9	0.3	19.4	969	-3.7	24	0.8	53.7	1603.3	243	363	691	1037	42	17	25	6	9	7	3
4J	4J5	4J5K71753	26	12	7	6	10	3	9.9	12.8	0.7	35.0	647	3.5	6.5	0.1	19.5	976	5.9	19	0.8	54.5	1622.5	150	123	671	547	223	3	2	1	1	8	5
4J	4J5	4J5K71701	26	36	2	17	14	6	9.9	13.2	0.7	35.7	660	10.5	13.9	0.3	19.8	990	6.6	27	1.0	55.5	1649.6	156	153	530	519	328	2	2	0	0	10	13
6J	6J2	6J2H84118	31	53	8	16	10	21	9.8	9.5	0.5	36.2	670	16.8	16.5	0.3	20.1	1006	-0.6	26	0.8	56.3	1675.6	403	348	1404	1217	20	70	61	20	17	6	2
1G	1G8	1G8N12550	22	32	8	9	8	12	9.8	7.5	0.4	36.6	677	10.0	7.7	0.2	20.3	1014	-4.5	15	0.6	56.9	1690.9	1313	1079	2808	2311	41	68	56	32	26	30	6
4I	4I3	4I3M70072	29	30	8	13	12	10	9.8	10.6	0.6	37.2	688	13.5	14.3	0.3	20.6	1028	1.6	25	0.9	57.7	1715.7	320	328	1414	1446	86	17	17	4	4	12	5
1L	1L6	1L6M26554	30	43	9	27	5	29	9.7	11.4	0.6	37.8	699	21.5	23.2	0.5	21.0	1051	3.3	35	1.1	58.8	1750.3	680	507	1523	1135	129	12	9	5	4	22	4
5J	5J1	5J1G54935	37	37	5	12	13	6	9.7	8.6	0.5	38.2	708	9.0	7.9	0.2	21.2	1059	2.3	16	0.6	59.4	1766.7	757	645	1647	1404	86	19	16	9	8	15	13
1N	1N2	1N2D13021	28	12	5	9	15	5	9.6	11.3	0.6	38.9	719	5.3	6.9	0.1	21.3	1066	3.3	18	0.7	60.2	1784.8	601	602	1316	1318	124	11	11	5	5	8	7
6J	6J3	6J3P59601	19	35	6	12	10	4	9.5	29.7	1.6	40.5	749	9.2	29.4	0.6	21.9	1095	40.4	59	2.2	62.4	1843.9	428	316	1173	864	334	4	3	1	1	19	9
4N	4N9	4N9C61554	25	20	12	11	6	10	9.5	15.2	0.8	41.3	764	8.0	13.7	0.3	22.2	1109	11.5	29	1.1	63.5	1872.8	390	349	1143	1022	94	12	11	4	4	10	2
4I	4I5	4I5A39180	23	51	5	16	10	10	9.5	13.7	0.7	42.0	777	12.7	16.9	0.3	22.5	1126	8.5	31	1.1	64.5	1903.4	289	237	1292	1062	559	2	2	1	0	18	8
6I	6I8	6I8D94565	29	43	5	21	10	8	9.4	12.1	0.7	42.7	790	12.4	15.2	0.3	22.8	1141	5.6	27	1.0	65.5	1930.7	592	707	1490	1767	32	46	54	18	22	7	4

RS in Co. 6D2 of Denver Bn

6D2 By RS
All sort on N+P+Del % DEL **0.5** Recruits per year per recruiter: **18.5** PS transfers per year per recruiter: **50**

BN	CO	RSID/ZIP	MEMBERS E1-3	MEMBERS E4-9	LOSSES E1-3	LOSSES E4-9	ENLISTMENT E1-3	ENLISTMENT E4-9	ADJ VAC N	ADJ VAC N+	RECRUTRS /ZIP	RECRUTRS CUMMULAT	NPS	ADJ VAC P	ADJ VAC P+	RECRUTRS /ZIP	RECRUTRS CUMMULAT	PS DELTA	ADJ VAC [N+P+Del]	RECRUTRS /ZIP	RECRUTRS CUMMULA	NPS+
RS D		TOTALS:	15	21	3	13	6	9	4.4	0.6	0.0	**	**	11.6	7.9	0.2	**	**	−7.5	8	0	**	**
6D	6D2	6D2D80501	6	14	2	7	1	6	1.7	0.0	0.0	0.0	0	7.7	6.0	0.1	0.1	6	−3.4	6	0	0.1	6
6D	6D2	6D2D80303	6	5	1	6	1	2	1.7	0.4	0.0	0.0	0	2.8	1.4	0.0	0.1	7	−2.7	2	0	0.2	8
6D	6D2	6D2D80516	3	2	0	0	4	1	0.9	0.2	0.0	0.0	1	1.1	0.4	0.0	0.0	2	−1.4	1	0	0.1	2
RS R		TOTALS:	23	54	6	25	9	20	7.4	7.3	0.4	**	**	23.6	23.5	0.5	**	**	−0.2	31	1	**	**
6D	6D2	6D2R80401	3	16	2	5	0	3	1.0	0.9	0.1	0.1	1	7.0	7.0	0.1	0.1	7	−0.0	8	0	0.2	8
6D	6D2	6D2R80227	7	7	1	4	5	4	2.3	2.2	0.1	0.2	3	3.1	3.0	0.1	0.2	10	−0.1	5	0	0.4	13
6D	6D2	6D2R80215	3	9	1	7	0	4	1.0	1.0	0.1	0.2	3	3.9	3.9	0.1	0.1	7	−0.0	5	0	0.3	10
6D	6D2	6D2R80033	2	8	0	5	0	3	0.6	0.6	0.0	0.4	8	3.5	3.5	0.1	0.5	27	−0.0	4	0	1.0	35
6D	6D2	6D2R80228	4	6	2	3	1	5	1.3	1.3	0.1	0.1	2	2.6	2.6	0.1	0.1	6	−0.0	4	0	0.2	8
6D	6D2	6D2R80235	2	4	0	1	1	0	0.6	0.6	0.0	0.1	2	1.8	1.7	0.0	0.1	4	−0.0	2	0	0.2	6
6D	6D2	6D2R80421	2	4	0	0	2	1	0.6	0.6	0.0	0.1	1	1.8	1.7	0.0	0.1	3	−0.0	2	0	0.1	5
RS V		TOTALS:	32	62	14	37	6	22	10.5	10.3	0.6	**	**	29.5	29.3	0.6	**	**	−0.5	40	1	**	**
6D	6D2	6D2V80221	7	18	4	15	1	6	2.3	2.2	0.1	0.1	2	8.6	8.5	0.2	0.2	9	−0.1	11	0	0.3	11
6D	6D2	6D2V80229	11	12	3	4	2	5	3.6	3.5	0.2	0.3	6	5.7	5.6	0.1	0.3	14	−0.1	9	0	0.6	20
6D	6D2	6D2V80233	5	12	3	10	2	8	1.6	1.6	0.1	0.3	5	5.7	5.7	0.1	0.2	11	−0.1	7	0	0.5	16
6D	6D2	6D2V80234	3	8	1	3	0	1	1.0	1.0	0.1	0.1	3	3.8	3.8	0.1	0.2	9	−0.1	5	0	0.3	12
6D	6D2	6D2V80022	3	7	2	5	1	1	1.0	1.0	0.1	0.1	1	3.3	3.3	0.1	0.1	3	−0.0	4	0	0.1	4
6D	6D2	6D2V80241	3	5	1	0	0	1	1.0	1.0	0.1	0.1	2	2.4	2.4	0.0	0.1	6	−0.0	3	0	0.2	8
RS W		TOTALS:	18	55	9	33	4	16	6.6	6.0	0.3	**	**	23.8	23.2	0.5	**	**	−1.3	29	1	**	**
6D	6D2	6D2W80003	2	18	2	6	0	3	0.7	0.6	0.0	0.0	1	7.8	7.7	0.2	0.2	8	−0.3	8	0	0.2	8
6D	6D2	6D2W80030	5	10	0	11	1	4	1.8	1.7	0.1	0.1	2	4.3	4.2	0.1	0.2	12	−0.3	6	0	0.4	14
6D	6D2	6D2W80004	4	10	1	8	0	2	1.5	1.4	0.1	0.2	3	4.3	4.2	0.1	0.2	8	−0.2	6	0	0.3	11
6D	6D2	6D2W80020	5	9	4	3	2	5	1.8	1.7	0.1	0.2	3	3.9	3.7	0.1	0.2	8	−0.3	5	0	0.3	11
6D	6D2	6D2W80002	2	8	2	5	1	2	0.7	0.7	0.0	0.4	7	3.5	3.4	0.1	0.5	27	−0.2	4	0	0.9	33